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EXTERNAL MEMORANDUM

TO:	Ron Bernal Assistant City Manager and Director of Public Works, City of Antioch
FROM:	Susan C. Paulsen, Ph.D., P.E. Ryan D. Thacher, Ph.D.
DATE:	January 27, 2017
PROJECT:	1405064.000
SUBJECT:	Technical Comments on WaterFix Final EIR/EIS

At the request of the City of Antioch (the City), Exponent is pleased to submit comments on the Final Environmental Impact Report/Environmental Impact Statement (FEIR/EIS) for the Bay-Delta Conservation Plan (BDCP)/California WaterFix (WaterFix) projects.[1]

The City's analysis of the impacts of the FEIR/EIS relies on the City's analyses of the modeling of Alternative 4A, the "preferred alternative," other model runs provided by the Department of Water Resources (DWR), and a review of the FEIR/EIS. The City of Antioch has previously submitted comments on the Recirculated Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement (RDEIR/SDEIS)[2], which are included in the administrative record for the FEIR/FEIS (and included as Attachment 1), and the City has submitted testimony to the State Water Resources Control Board (State Water Board) as part of the proceedings to consider a petition to change the water rights of DWR and the U.S. Bureau of Reclamation for the California WaterFix Project. The City's testimony to the State Water Board is provided as Attachment 2A and is referenced within these comments. In addition, the City of Antioch has been working closely with other Delta agencies and reserves the right to rely on other comments submitted, including those submitted by the City of Brentwood, the City of Stockton, and Sacramento Regional County Sanitation District.

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1 Exponent has undertaken a diligent effort to identify the components of the FEIR/EIS that are relevant to the City's comments, and we have thoroughly reviewed the FEIR/EIS response to comments and sections/references cited in the response to the City's comments. However, given the size of the FEIR/EIS and the time available to comment, we have not reviewed the entire FEIR/EIS. The City had requested a time extension to comment by way of its special counsel, Matthew Emrick, but that request was not granted at the time of these comments.

2 Attachment 1: Exponent (2015). Technical Comments on the Draft Bay Delta Conservation Plan (BDCP) and Associated Draft Environmental Impact Report and Environmental Impact Statement (RDEIR/SDEIS). Submitted to WaterFix Comments. October 27, 2015.

While we appreciate the State's efforts to address comments provided for the RDEIR/SDEIS, many issues brought to the attention of the State were not addressed in the responses to the City's comments or in the Master Responses.

Exponent's major comments on the FEIR/EIS can be summarized as follows:

1. The FEIR/EIS uses an inappropriate existing conditions model run (baseline)
2. DWR has not defined the operations of the proposed WaterFix project
3. The WaterFix Project will result in adverse unmitigated impacts to water quality at the City's intake
4. The Adaptive Management and Monitoring Program remains undefined, and it is not possible to ascertain impacts to the City without understanding how the WaterFix project will be operated
5. The impacts of the WaterFix Project are not disclosed in the FEIR/EIS

Background

In addition to the considerable volume of documentation produced throughout the BDCP/WaterFix project evolution, a large number of modeling files have been released over the years to support proposed project alternatives. In past comment letters, technical reports, and testimony, Exponent has relied in part on the model files released by DWR in their technical analyses. DWR used the Delta Simulation Model II (DSM2) to simulate hydrodynamics and water quality throughout the Delta for a range of model conditions and operational scenarios. In an effort to clarify further discussions of modeling and model files, Table 1 provides a record of the DSM2 files in Exponent's possession, and the documents and scenarios they were intended to support. This list is not intended to be comprehensive but reflects the model files Exponent has reviewed.

Table 1. Exponent's record of model files released by DWR in support of the BDCP/WaterFix project.

Accompanying Document	Model Files Acquired by Exponent[a]
March 2013 Revised Administrative Draft BDCP	EBC1, EBC2, NAA (ELT, LLT), and project alternatives, including Alternative 4 (H1, H2, H3, H4) at ELT and LLT
2013 Draft EIR/EIS	EBC1, NAA (ELT, LLT), and project alternatives, including Alternative 4 (H1, H2, H3, H4) at ELT and LLT
2015 RDEIR/SDEIS	Updated 2013 Draft EIR/EIS model files and sensitivity analyses ; Alternative 4A (or H3+) introduced as the preferred alternative, but not modeled
Draft BA model files (released January 2016, prior to document release)	NAA (ELT), Preferred Alternative (Alternative 4A)
FEIR/EIS model files (released March 2016, prior to document release)	NAA (ELT), Alternative 2D, Alternative 4A, Alternative 5A
WaterFix Petition (May 2016)	Boundary 1, Boundary 2, NAA, H1, H2, H3, H4

[a] EBC1 = existing baseline condition without the Fall X2 standard; EBC2 = existing baseline condition including the Fall X2 standard; NAA = no action alternative; ELT = early long term (i.e., 2025 with 15 cm of sea level rise); LLT = late long term (i.e., 2060 with 45 cm of sea level rise)

Many of the technical analyses presented in this comment letter rely on the modeling results provided by DWR, which are provided in 15-minutes time-steps.[3] These data are summarized in a variety of ways in our analyses, and are often grouped by specific water year type. Hydrology in the Delta varies from year to year. Water years in the Delta, defined as October through September, are classified as wet, above normal, below normal, dry, or critical. DWR determines the water year type by calculating a water year index number, which accounts for both the hydrology of the current year and the previous year's index. By this classification system, the water years modeled in DSM2 by DWR fall into the following categories:

- Critical: 1976, 1977, 1988, 1990, 1991
- Dry: 1981, 1985, 1987, 1989
- Below Normal: 1979
- Above Normal: 1978, 1980
- Wet: 1982, 1983, 1984, 1986

Because there is only one Below Normal water year in the 16-year DSM2 modeled record, Exponent combined results for the Below Normal year with model results for Above Normal water years for the purposes of analyzing the WaterFix model runs; the water year type for water years 1978-1980 is referred to from here forward as "Normal." In some analyses, data were averaged by month or by water year type by aggregating data from those specific months or water year types and calculating an average. For example, the daily average chloride concentration during March of dry water years was calculated by sorting the DSM2 results into bins such that the simulated salinity values for each day in March from years 1981, 1985, 1987, and 1989 were grouped and could then be averaged.

1. The EIR uses an inappropriate existing conditions model run

The City's comments on the RDEIR/SDEIS describe DWR's use of a baseline that does not include the Fall X2 salinity standard, and the City's concern with and objection to DWR's choice of baseline. The City and Exponent have also provided comments on the baselines used in DWR's analyses in written form and in oral testimony during the State Water Resources Control Board (State Board)'s proceedings on the Petition filed by DWR and the U.S. Bureau of Reclamation Requesting Changes in Water Rights for the California WaterFix Project (WaterFix Change Petition Proceedings). We hereby attach and incorporate by reference the technical report (Attachment 2A) submitted in the State Board's WaterFix Change Petition Proceedings.[4]

[3] The BA model results were provided as daily averages; the BA modeling is not addressed in this letter.

[4] Attachment 2A: Exponent (2016). Report on the Effects of the Proposed California WaterFix Project on Water Quality at the City of Antioch. Exhibit Antioch-202, WaterFix Change Petition Proceedings. August 30, 2016. See also Attachment 2B: Transcript of oral testimony and cross of Susan Paulsen in the WaterFix Change

The FEIR/EIS continues to use both an existing condition (EBC1) and future no-action alternative (NAA) as baseline conditions against which Alternative 4A project conditions are compared. However, the existing condition scenario (EBC1) does not include the Fall X2 requirement, despite the fact that the 2008 USFWS biological opinion (BiOp) requires it. The FEIR/EIS states the reason for this exclusion of Fall X2 as follows: "As of spring 2011, when a lead agency technical team began a new set of complex computer model runs in support of this EIR/EIS, DWR determined that full implementation of the Fall X2 salinity standard as described in the 2008 USFWS BiOp was not certain to occur within a reasonable near-term timeframe because of a recent court decision and reasonably foreseeable near-term hydrological conditions. As of that date, the United States District Court had not yet ruled in litigation filed by various water users over the issue of whether the delta smelt BiOp had failed to sufficiently explain the basis for the specific location requirements of the Fall X2 action, and its implementation was uncertain in the foreseeable future." (FEIR/EIS at p. 4-6)

However, after the U.S. District Court's ruling in March 2011 that the BiOp insufficiently explained the basis for Fall X2 location requirements, in March 2014—almost three years before the issuing of the FEIR/EIS—the Ninth Circuit U.S. Court of Appeals overturned the District Court's ruling on this point, finding that the BiOp did sufficiently explain the basis of the specific Fall X2 location requirements (*San Luis vs. Jewell,* Case No. 11-15871). Thus, the pending litigation referred to in the FEIR/EIS has long since been resolved, and the Fall X2 requirement should have been included in the existing condition baseline scenario, together with the other 2008 BiOp requirements that were included in the baseline existing condition. Moreover, a second existing condition baseline model run that includes the Fall X2 requirements (EBC2) was conducted by DWR in connection with the Administrative Draft BDCP EIR/EIS and released to the public in 2013. This baseline model run (EBC2) was thus available to DWR at the time the RDEIR/SDEIS and FEIR/EIS were prepared. This EBC2 baseline condition should have been used to evaluate the impacts of Alternative 4A. Thus, the EBC1 existing condition scenario employed as a baseline in the FEIR/EIS is insufficient since it lacks the Fall X2 requirement and does not accurately reflect existing conditions.

A detailed discussion of the existing baseline condition and the failure of the EBC1 model scenario to capture actual existing conditions can be found in the City's comments on the RDEIR/SDEIS.[5]

(Continued from footnote 4)… Petition Proceedings

5 See Section 4.1 (p. 3-4) of Exponent's Technical Comments on the RDEIR/SDEIS.

2. DWR has not defined the operations of the proposed WaterFix project

2.1. DWR has stated that it may operate to the Boundary scenarios and that these scenarios should be evaluated to understand the impacts of the proposed WaterFix Project.

DWR testified before the State Board to evaluating "a range call [sic] Boundary 1 to Boundary 2. And the purpose of that is because… this project also includes the collaborative science and adaptive management program and the ability to make adjustments to the initial operating criteria based on science and monitoring… So Boundary 1 and 2 represent what we think at this time, based on those uncertainties, are the range of potential adjustments that may be made."[6] During cross-examination in the WaterFix Change Petition Proceedings, DWR stated that it is appropriate to "evaluate the effects of Boundary 1 and the effects of Boundary 2" in evaluating potential injury from the WaterFix flow proposal. [7]

Figure 1 shows DWR's visual representation of how Boundary 1, Boundary 2, and some of the proposed project alternatives noted in Table 1 compare in terms of Delta outflow. The Boundary 1 scenario was the primary focus of Exponent's technical analyses presented in testimony during Part 1B of the WaterFix Change Petition Proceedings on behalf of the City, and Exponent determined that the Boundary 1 scenario results in adverse water quality impacts to the City.[8]

[6] See p. 20 of Attachment 3 - Transcript of Jennifer Pierre Oral Testimony before the SWRCB in the WaterFix Change Petition Proceedings, recorded July 29, 2016.

[7] See pp. 151-152 of Attachment 3 - Transcript of Jennifer Pierre Oral Testimony before the SWRCB in the WaterFix Change Petition Proceedings, recorded July 29, 2016.

[8] See Section 8 (p. 37) of Attachment 2A.

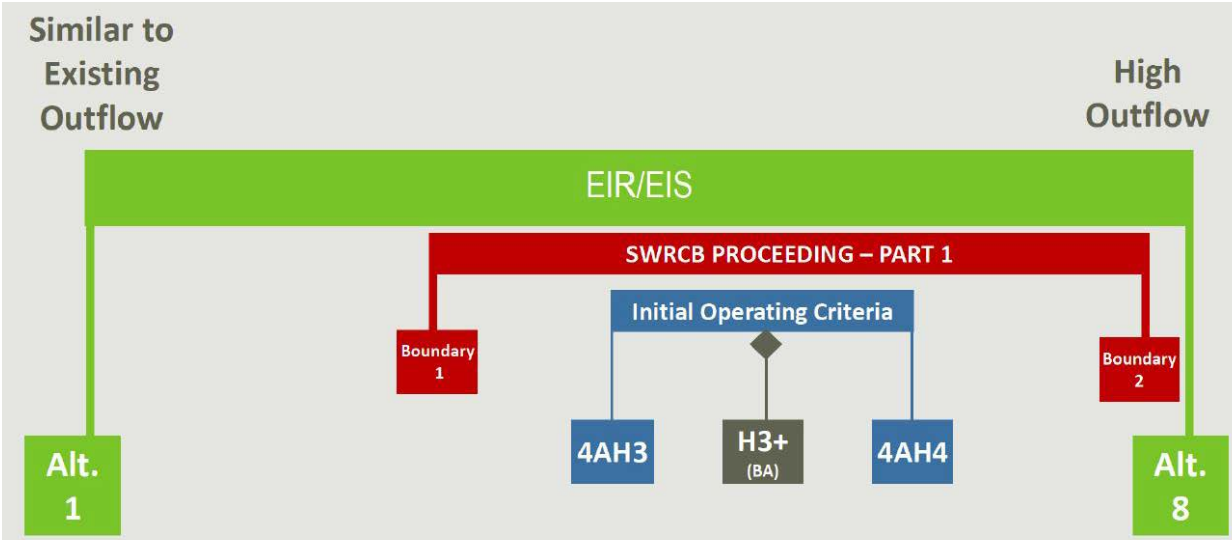

Figure 1. Comparison of proposed alternatives from the EIR/EIS, SWRCB proceedings (WaterFix petition), and the proposed initial operating criteria.[9]

2.2. Water quality impacts are anticipated to be worse than presented in DWR's modeling

DWR has modeled the impacts of the WaterFix Project for two time horizons: the "early long term" (ELT, corresponding to 2025 and an anticipated sea level rise of 15 cm) and the "late long term" (LLT, corresponding to 2060 and an anticipated sea level rise of 45 cm). Both scenarios were presented in earlier versions of the EIR/EIS for the project (see Table 1 of these comments). In Appendix 8G, DWR presents modeled chloride results for Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9 as LLT, but presents Alternatives 4A, 2D, and 5A as ELT. The source water fingerprinting results presented in Appendix 8D uses these same time frames. The proposed WaterFix Project will not be operational until *after* 2025, and project operation is anticipated to continue for the indefinite future; thus, it is unclear why DWR chose not to evaluate and present the LLT model results for Alternative 4A in the FEIR/EIS. The impact determinations made for chloride in Chapter 8 for Alternative 4A are almost entirely based on the ELT, with the exception of broad statements such as, "the effects of Alternative 4A in the LLT in the Delta region, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be similar to effects in the ELT. With greater climate change and sea level rise, additional outflow may be required at certain times to prevent increases in chloride in the west Delta."[10]

2.3. It does not appear that DWR modeled the LLT timeframe for the preferred alternative. For this reason, the impacts presented in the FEIR/EIS for Alternative 4A are expected to underestimate actual

[9] WaterFix Change Petition Proceedings Exhibit DWR-1, p. 10.

[10] FEIR/EIS p. 8-931.

adverse impacts, and these impacts are not disclosed in the FEIR/EIS. The Boundary Scenarios are fundamentally different than the preferred Alternative 4A

2.3.1. Boundary 1 results in higher exports compared to Alternative 4A

Model results show more water will be exported from the Delta under the Boundary 1 scenario than scenario Alternative 4A in all water year types. Table 2 compares the modeled volume of water exported from the Delta (via the Jones and Banks Pumping Plants and the proposed North Delta Diversions) for Alternative 4A and Boundary 1 for each water year type. To generate the values in Table 2, DSM2 data were averaged for each month in the simulation period, sorted by water year type, and averaged. During dry water years the Boundary 1 scenario results in an average of 1,046 thousand acre-ft (TAF) (1.046 million acre-ft [MAF]) of additional water exported from the Delta. During wet and normal years, Boundary 1 results in 622 TAF and 638 TAF of additional exports, respectively.

Table 2. Annual average volume of water in thousands of acre-ft (TAF) exported from the Jones and Banks Pumping Plants and the proposed North Delta Diversion points for each water year type for the 16-year modeled period (1976-1991).

Water Year Type	Alternative 4A (TAF)	Boundary 1 (TAF)	Difference of Boundary 1 and Alternative 4A (TAF)
Wet	6,376	6,998	622
Normal	5,668	6,306	638
Dry	4,189	5,236	1,046
Critical	2,748	3,036	288
Average	4,745	5,394	649

For individual months, the difference in the amount of water exported from the Delta using Boundary 1 operations relative to Alternative 4A can be much greater than the average values shown in Table 2. Figure 2 shows the modeled monthly average flow rate of water exported from the Delta for the EBC2, NAA, Boundary 1, and Alternative 4A scenarios for water years 1979 and 1985. During April and May of 1979 (a normal water year), Boundary 1 results in an export rate of approximately 8,000 cfs, which is four to five times higher than for scenarios EBC2, NAA, and Alternative 4A. During October and November of 1979, Boundary 1 exports are about 8,000 and 10,000 cfs, respectively, and Alternative 4A exports are approximately 5,200 and 5,900 cfs, respectively. During October through January of water year 1985, Boundary 1 results in an average additional export of approximately 5,900 cfs compared to Alternative 4A. With the exception of August, Boundary 1 exports are greater than Alternative 4A exported for every month of 1985. Water export totals for all years of the modeled record are included in Attachment 4A.

Thus, DWR's model data show that the Boundary 1 scenario would result in greater annual exports from the Delta than Alternative 4A in all year types, and as much as four to five times greater export volumes in some months. Based on our analysis of export volumes, Exponent concludes that the Boundary 1 scenario is markedly different from Alternative 4A.

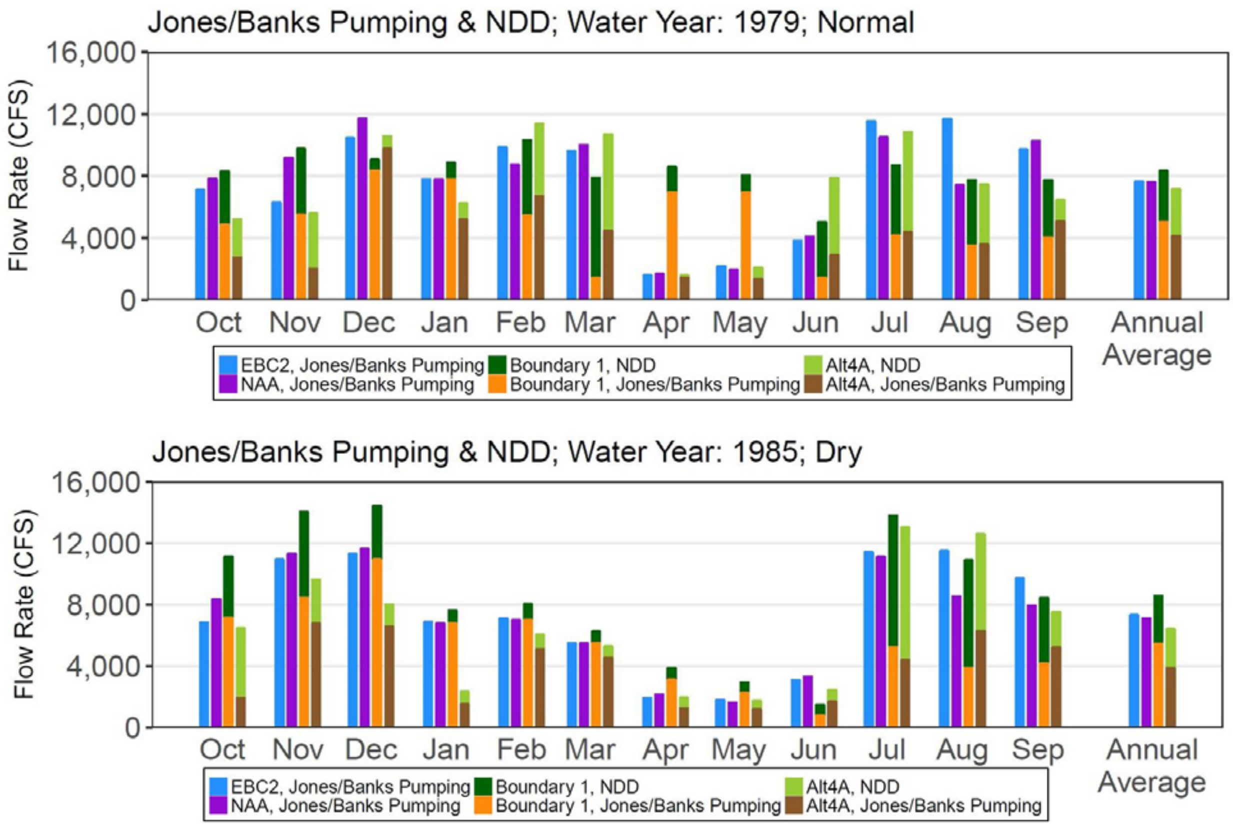

Figure 2. Modeled monthly average flow rate of water exported through the Jones and Banks Pumping Plants and the proposed North Delta Diversion points for the EBC2, NAA, Boundary 1, and Alternative 4A (Alt 4A) scenarios for select years. Monthly average flow rate was calculated from DSM2 output provided by DWR for each year of the 16-year modeled record.[11]

2.3.2. The Boundary 1 scenario will cause higher chloride levels at the City's intake than Alternative 4A

There are distinct differences between scenarios Boundary 1 and Alternative 4A in the concentration of chloride modeled at the City's intake on the San Joaquin River. DSM2 output (provided by DWR) was used to evaluate chloride concentrations at Antioch's intake for the 16-year modeled period. Data were averaged to generate daily average chloride concentrations, then sorted by water year type and averaged to produce daily average salinity for each water year type. Results from this analysis are shown in Figures 3 and 4 for normal and dry water year

[11] See Attachment 4A for the total exports from the Delta for all modeled years.

types. During normal water years, the Boundary 1 scenario results in chloride concentrations at the City's intake that are as much as 1,500 mg/L higher than the Alternative 4A scenario during fall (Figure 3). During September through December of dry water years, model results show salinity is approximately 500-1,750 mg/L higher for the Boundary 1 scenario than Alternative 4A (Figure 4).[12] The maximum difference in chloride between the two scenarios (1,750 mg/L) occurs during October.

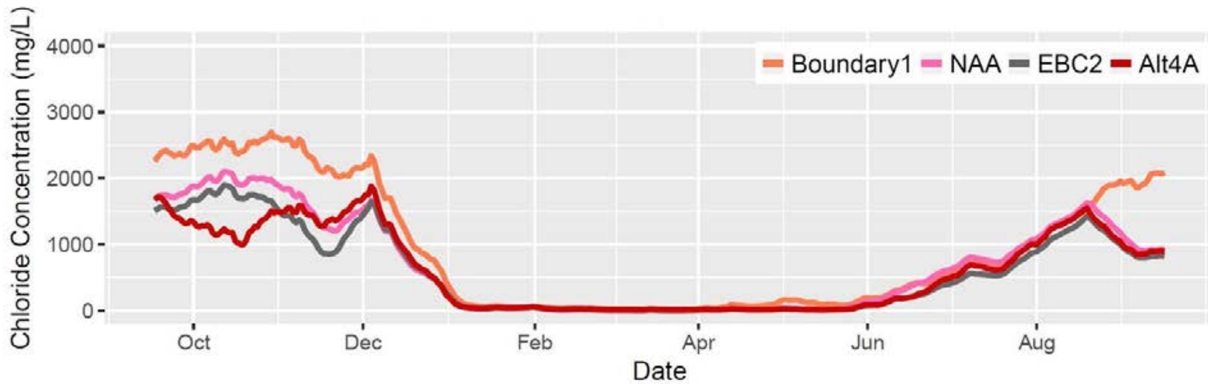

Figure 3. Daily average chloride concentration at Antioch's intake location averaged for normal water years (i.e., for 1978, 1979, 1980). DWR's DSM2 15-minute salinity data were averaged for each day of the 16-year modeled record, then sorted by water year type and averaged for normal years to produce an aggregate daily average chloride for normal water years.

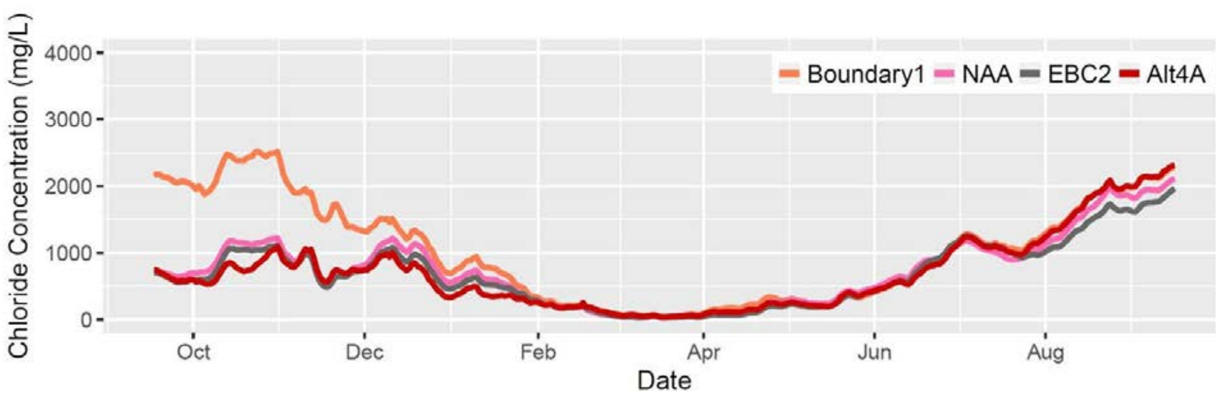

Figure 4. Daily average chloride concentration at Antioch's intake location averaged for dry water years (i.e. 1981, 1985, 1987, and 1989). DWR's DSM2 15-minute salinity data were averaged for each day of the 16-year modeled record, then sorted by water year type and averaged again to produce an aggregate daily average chloride for dry water years.

[12] Daily average chloride figures were produced for wet and critical water year types as well, and for all individual years of the 16-year modeled record. Results are included as Attachment 4B.

Differences in salinity can be much more substantial between Boundary 1 and Alternative 4A on shorter time frames. Figure 5 shows the daily average salinity for the dry water year of 1987. During September through December, the difference in salinity between Boundary 1 and Alternative 4A is as high as 2,200 mg/L, and the Boundary 1 salinity remains elevated through January. Water year 1979 (a normal water year) (Figure 6) shows chloride concentrations modeled for the Boundary 1 scenario range from 1,600 mg/L to 2,600 mg/L during September through January, much higher than Alternative 4A (chloride ranges from approximately 500-1,000 mg/L for Alternative 4A for the same time period). Clearly, the modeled salinity for Boundary 1 and Alternative 4A is markedly different through the fall and winter months. The FEIR/EIS did not include analyses that could be used by the City to assess the water quality impacts expected if project operations evolved from Alternative 4A to Boundary 1.

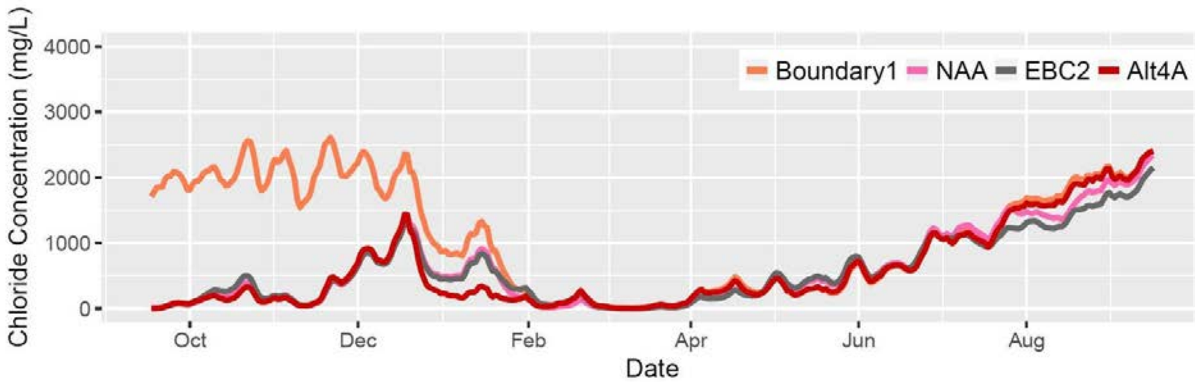

Figure 5. Daily average salinity during the 1987 water year (a dry water year). DWR's DSM2 15-minute salinity data were averaged for each day of the 16-year modeled record to generate the daily average chloride concentration at Antioch's intake location during the dry water year of 1987.

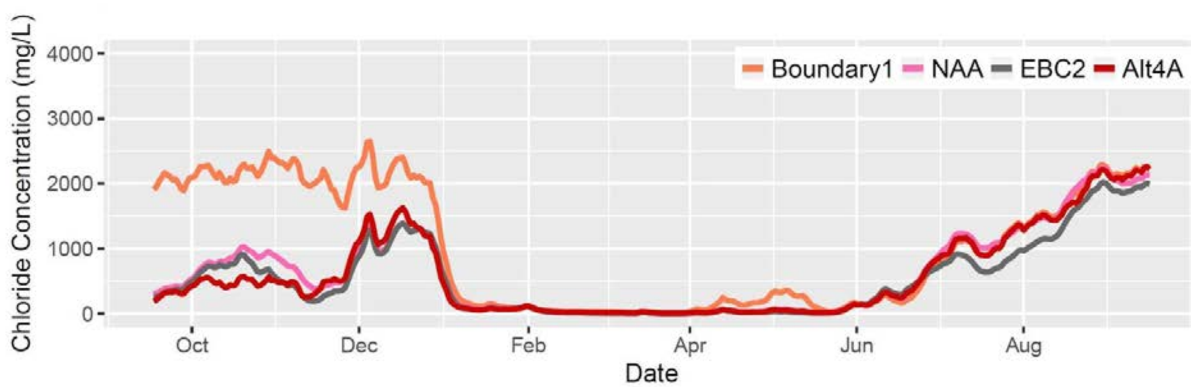

Figure 6. Daily average salinity during the 1979 water year (a normal year). DWR's DSM2 15-minute salinity data were averaged for each day of the 16-year modeled record to generate the daily average chloride concentration at Antioch's intake location during the dry water year of 1979.

As discussed in testimony by Ron Bernal during the WaterFix Change Petition Proceedings,[13] the 250 mg/L chloride threshold is relevant to the City because when salinity is above this level the City cannot use water from their intake on the San Joaquin River. Exponent converted DSM2 salinity output data from 15-minute intervals to daily averages at Antioch and compared these calculated daily averages to the 250 mg/L threshold. The number of days over the 16-year modeled period that chloride concentrations exceeded 250 mg/L for Alternative 4A and Boundary 1 are shown in Table 3. The difference in the number of days that salinity exceeds the 250 mg/L threshold for the Boundary 1 and Alternative 4A scenarios indicates a significant loss of the City's ability to use water at its intake during many of the modeled years (1976-1991). For example, in 1979 (normal water year), the Boundary 1 scenario results in 38 additional days the 250 mg/L threshold is exceeded, and during dry years 1985 and 1987, the Boundary 1 scenario results in 85 and 79 additional days above the threshold, respectively. For nine of the sixteen modeled years, the Boundary 1 scenario results in at least 30 additional days (a full month) relative to Alternative 4A when chloride concentrations are simulated to exceed the 250 mg/L threshold. Over the entire 16-year modeled record, DWR's model results indicate that the Boundary 1 scenario will exceed the 250 mg/L chloride threshold 548 additional days (1.5 years) compared to Alternative 4A.

In summary, DWR's model results indicate that simulated chloride concentrations at the City's intake will be different under the Boundary 1 scenario than under Alternative 4A; specifically, the Boundary 1 scenario is predicted to result in the loss of as many as 1.5 years of useable water relative to Alternative 4A over the 16-year DSM2 simulation period.

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[13] See Attachment 5, p. 4 lines 23-24.

Table 3. DSM2 results for the 16-year modeled period showing the number of days per year chloride concentrations exceed the 250 mg/L threshold at the City's intake.

Water Year	Water Year Type	Total Days	No. of Equivalent Days Exceeding Threshold: Alternative 4A	No. of Equivalent Days Exceeding Threshold: Boundary 1	Difference of Boundary 1 and Alt 4A	Percent Increase
1976	Critical	366	249	330	81	33%
1977	Critical	365	351	362	12	3%
1978	Normal	365	177	191	14	8%
1979	Normal	365	182	219	38	21%
1980	Normal	366	161	195	34	21%
1981	Dry	365	221	261	40	18%
1982	Wet	365	107	143	35	33%
1983	Wet	365	16	23	6	40%
1984	Wet	366	88	133	45	51%
1985	Dry	365	154	239	85	55%
1986	Wet	365	161	200	39	24%
1987	Dry	365	200	278	79	40%
1988	Critical	366	283	290	7	2%
1989	Dry	365	265	272	6	2%
1990	Critical	365	290	307	17	6%
1991	Critical	365	306	315	9	3%
		Sum	3210	3758	548	17% (Avg.)

2.3.3. The composition of water at the City's intake is different for the Boundary 1 Scenario than for the Alternative 4A Scenario

Delta channels are below sea level and will always contain water, but the source of the water will change as water is exported from the system. Particularly in the western Delta, the salinity of water reflects the balance between freshwater inflows and more saline water that is carried into the estuary from San Francisco Bay with the tides. If more fresh water is removed from the system, Delta outflow will decline, and higher salinity water from San Francisco Bay will flow into the Delta.

Water within the Delta originates from many water sources, including the Sacramento River, the San Joaquin River, a group of streams that originate to the east of the Delta (the Eastside Streams), inflow from Martinez, inflow from the Yolo bypass, and agricultural return flows. As noted in the FEIR/EIS, "Water quality in the Delta at any given location and time is primarily the result of the sources of water to that location."[14] The Sacramento River and Eastside Streams, for example, have salinity levels of about 100 mg/L (measured as total dissolved solids [TDS])[15], while salinity is "elevated in the San Joaquin River inflows as a result of irrigated agricultural drainage on southern San Joaquin Valley soils of marine origin that are naturally high in salts, and from salts in Delta waters that are used for irrigation and returned back to the Delta."[16] For example, the salinity of the San Joaquin River varied seasonally in 2015 from 48 to 776 mg/L TDS (average 343 mg/L TDS).[17] San Joaquin River water is typically higher in salinity, chloride, bromide, and other chemicals than water from other freshwater sources to the Delta.[18] The salinity of water within the Delta is determined by the source fractions at any given location; if the fraction of Sacramento River water decreases and that water is replaced by Bay water, or by San Joaquin River water and agricultural return flows, water quality will decline.

Exponent conducted source water fingerprinting to identify the relative amounts of water from various sources at the City's intake. Exponent used DSM2 and DWR's DSM2 input files to conduct fingerprinting analyses.[19] Source water fingerprinting was performed to show the source water fraction at the City's intake for various operational scenarios. Figures 7 and 8 show the average daily source water fractions at the City's intake for the Boundary 1, Boundary 2, and Alternative 4A scenarios for dry and normal water years, respectively (fingerprinting results are for all water year types are included as Attachment 4C). Each figure shows the fraction of a different source of water at the City's intake: the Sacramento River (top left), the San Joaquin River (bottom left), inflow from Martinez (top right), and agricultural return flows (bottom right). During dry water years (Figure 7), modeling shows that the fraction of Sacramento River source water will vary between the Boundary 1 and Boundary 2 scenarios (orange and yellow lines, respectively) by nearly 20% in September and October, and approximately 10% during March through June. The source fractions of Sacramento River water for Alternative 4A, shown in red, fall between Boundary 1 and Boundary 2 for most of the year. Reductions in the fraction of Sacramento River are accompanied by increases in the fraction of water from Martinez (top right panel of Figure 7), and to a lesser degree, San Joaquin River water (particularly for the Boundary 2 scenario; see the lower left panel of Figure 7). From October through March of dry years, modeling shows that flows from Martinez will constitute between 0% and 40% of the water present at the City's intake for the Boundary 1 scenario, and from 0-15% for Boundary 2. From November through February of dry years, the source fraction of Martinez water for Alternative 4A is bound between the Boundary scenarios.

During normal water years, the source water fraction of San Joaquin River water comprises 35-45% of the source water at Antioch's intake from mid-February through June for the Alternative 4A and Boundary 2 scenarios (bottom left panel of Figure 8). During October and November of

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14 FEIR/EIS, p. 8-34.

15 See Attachment 2A, Section 6b, p. 46.

16 FEIR/EIS pp. 8-56/57.

17 See Attachment 2A, Section 6b, p. 46.

18 See Attachment 2A Section 6b, p. 46.

19 See Attachment 2A Section 3.1 for methods used to in source water fingerprinting.

normal water years, the Sacramento River comprises approximately 65-75% of the water at the City's intake under Alternative 4A, but only 60% under the Boundary 1 scenario. Much of that 15% difference is due to additional inflows from Martinez for the Boundary 1 scenario (top right panel of Figure 8).

Because the composition of water at the City's intake is significantly different under the Alternative 4A scenario than under either the Boundary 1 or Boundary 2 scenarios, and because the composition of water directly determines the quality of water at the City's intake, the FEIR/EIS should have presented this information in a detailed, quantitative manner, and should have discussed this information within the body of the FEIR/EIS.

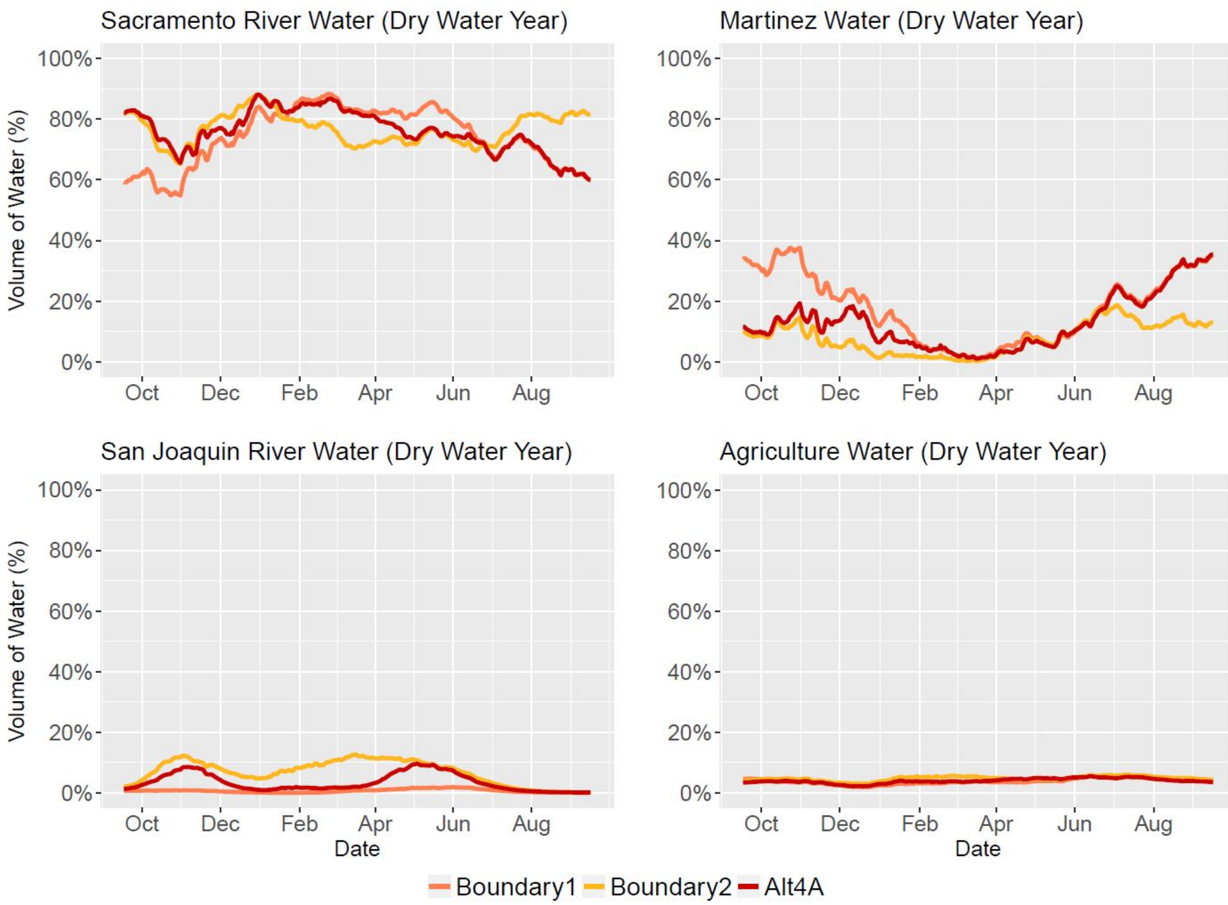

Figure 7. Source water fingerprints at the City of Antioch's intake location for the Boundary Scenarios and Alternative 4A for dry water years (1981, 1985, 1987, and 1989).

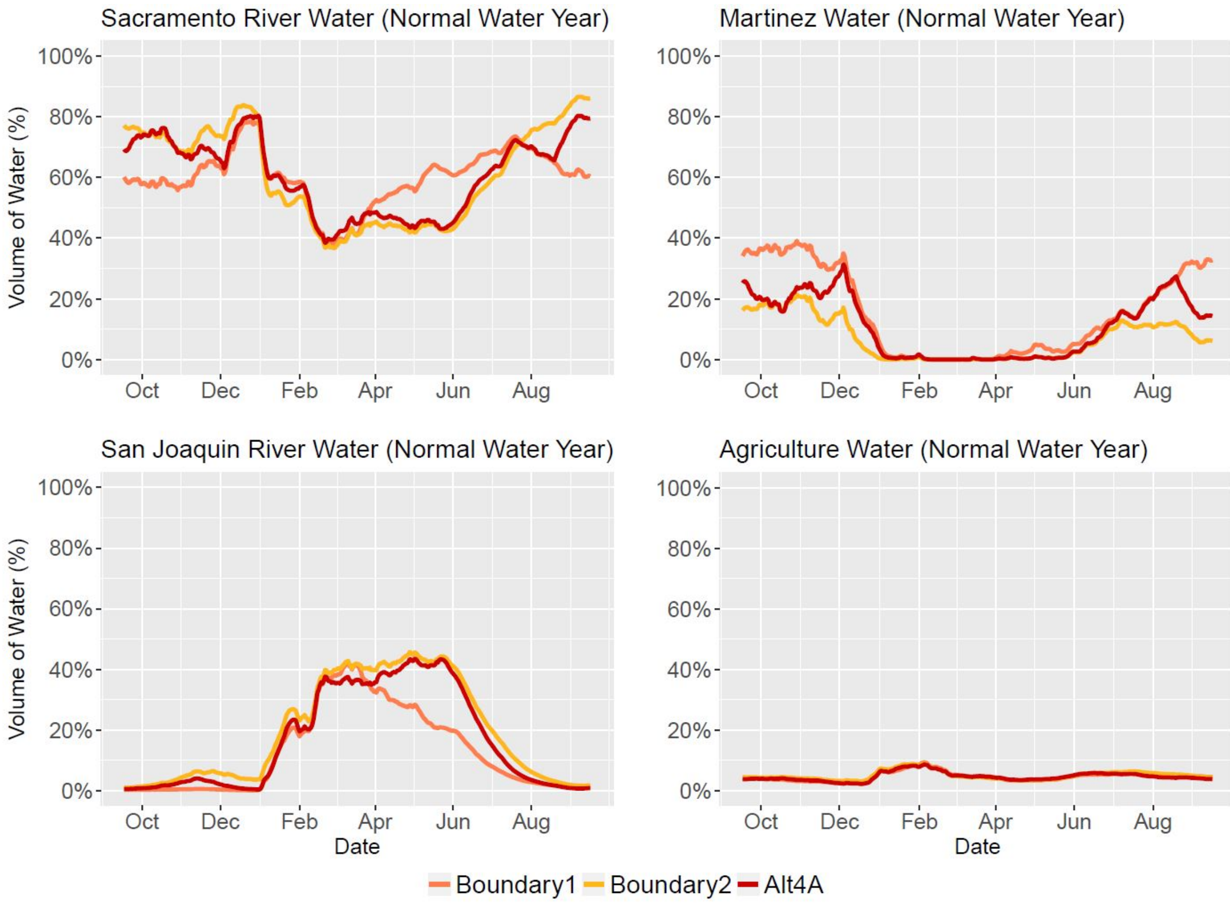

Figure 8. Source water fingerprints at the City of Antioch's intake location for the Boundary Scenarios and Alternative 4A for normal (above and below normal) water years (1978, 1979, and 1980).

2.3.4. Alternative 4A will change the composition of water at the City's intake compared to the NAA scenario, causing water quality degradation

DWR did present limited source water fingerprinting for Alternative 4A and for the baseline scenarios (the no action alternative [NAA] and DWR's chosen existing condition scenario, EBC1) within Appendix 8D of the FEIR/EIS. As noted above, DWR did not present source water fingerprinting for the Boundary 1 and Boundary 2 scenarios within the FEIR/EIS, and DWR did not present fingerprinting results for the correct existing condition scenario (EBC2).

The volumetric source fingerprinting performed by DWR shows the changes in source water that are anticipated to occur at the City's intake between Alternative 4A and the EBC2 and NAA scenarios. Figure 9 (bottom panel) shows DWR's fingerprinting results presented as a 16-year (1976-1991) average *change* in monthly source volume at the City's intake relative to the NAA scenario; this figure is copied directly from the FEIR/EIS. The yellow bars above the x-axis indicate an *increase* in San Joaquin River water, and the green bars below the x-axis indicate a *decrease* in Sacramento River water. During the months of February through

September, as much as 7% of the Sacramento River water at the City's intake is simulated to be replaced with lower quality water sources, such as San Joaquin River water. Fingerprinting for Alternative 4A was conducted by DWR only for the ELT time frame (2025), while it was performed for the LLT time frame for proposed operational scenarios 1–9.[20] Effects on water quality at the City's intake in the late long term are anticipated to be more significant than in the early long term.

DWR also presented the change in source water fraction at the City's intake for the EBC1 scenario. As shown in Figure 9 (top panel), significant source water changes are expected to occur for the Alternative 4A scenario relative to the existing conditions scenario (EBC1). The water quality impacts are slightly reduced when Alternative 4A impacts are compared to the NAA (bottom panel of Figure 9), but show the same trend. During December through August, the Sacramento River water source fraction will be reduced for Alternative 4A relative to the NAA, and will be replaced primarily by San Joaquin River water. During an average March, the fraction of Sacramento River water will be reduced by 7% and the fraction of San Joaquin River water will increase by 7% for Alternative 4A relative to the NAA. (As detailed in Section 1, the EBC1 scenario is not representative of existing conditions because it does not include operations to meet Fall X2 requirements; as a result, salinity is generally higher in the EBC1 scenario than in the existing conditions EBC2 scenario. Thus, the impacts of Alternative 4A will be even greater than those shown in the top panel of Figure 9.)

[20] FEIR/EIS Appendix 8D – Source Water Fingerprinting Results

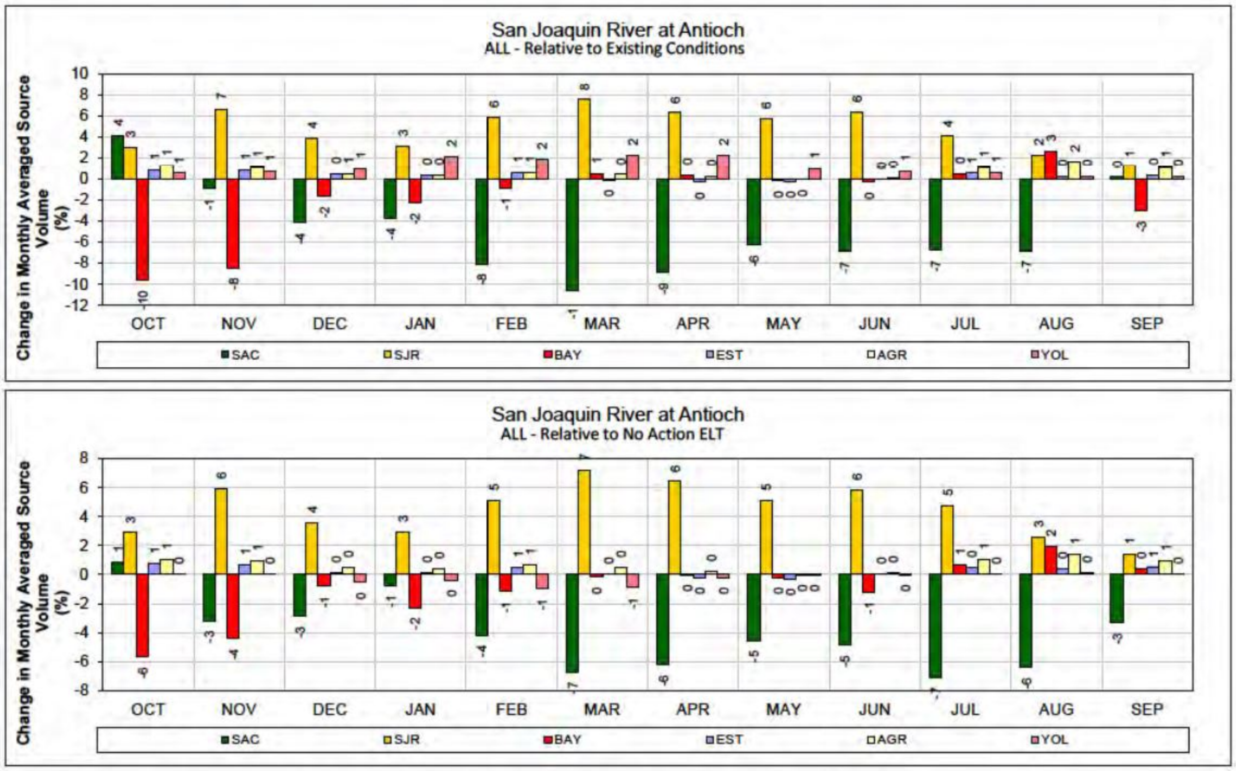

Figure 319. ALT 4A –San Joaquin River at Antioch for ALL years (1976-1991)

Figure 9. Change in average monthly source volume relative to the NAA early long term scenario.[21]

Figure 9 demonstrates that DWR conducted and presented analyses within the FEIR/EIS showing that the source of water at the City's intake would change significantly. As described in Section 3 of these comments, these changes in source water correspond with significant water quality degradation at the City's intake. Yet DWR concluded within the FEIR/EIS that the impacts of the preferred alternative (Alternative 4A) were "less than significant" at the City of Antioch's intake; DWR's conclusion is not supported by their own analysis and presentation of results within the FEIR/EIS.

2.3.5. The WaterFix may export not only more water from the Delta, but more high-quality Sacramento River water, causing adverse water quality impacts at the City's intake

Exponent's testimony in the State Board's WaterFix Change Petition Proceeding demonstrated that not only will the proposed WaterFix project (Boundary 1 and H3 scenarios) export more water from the Delta than is currently exported, these operations scenarios will export more *Sacramento River water* from the Delta than is currently exported. Because the new NDD intakes are located on the Sacramento River in the northern part of the Delta, water exported from

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[21] FEIR/EIS p. 8D-349.

these locations will consist almost entirely of Sacramento River water. In contrast, water exported from the South Delta pumping locations consists of water from several sources, including the Sacramento River, the San Joaquin River, eastside streams, and agricultural return flows. Under operational scenario Boundary 1, an additional 1,200,000 acre-feet per year of exports will occur (on average), and as shown in Figures 7 and 8 (and Attachment 4C), the fraction of Sacramento River water at the City's intake will decline in all year types.

The chloride concentration at the City's intake is correlated with the percentage of water from Martinez at the intake: chloride concentrations are high when the percentage of Martinez water is high (by volume). (I have previously examined the ability of DSM2 to simulate salinity within the Delta. Although DSM2's ability to simulate salinity and chloride concentrations within the interior Delta, particularly the south Delta, is limited, DSM2 is better able to simulate salinity at Antioch, in large part because much of the salinity at Antioch's intake derives from Bay water. See the City's comments on the RDEIR/SDEIS for additional detail.[22]) Chloride concentrations are also generally inversely correlated with the percentage of Sacramento River present at the City's intake: a higher percentage of Sacramento River water correlates to a lower salinity.

The fingerprinting analysis shows that for nearly all water year types and months, the fraction of Sacramento River water at the City's intake will be lower for operational scenario Boundary 1 than for scenarios EBC2 and NAA (Figure 10). In some year types, this "lost water" will be made up primarily by San Joaquin River water. For example, in March of normal water years, the fraction of Sacramento River water decreases by 20% on average under scenario Boundary 1 relative to EBC2 and NAA baselines, while the fraction of San Joaquin River water increases by 20% (Figure 11). The increase in the fraction of San Joaquin River water results in degraded water quality at the City's intake.

Simulation results show that during most water year types the fraction of water from Martinez (the Bay) at Antioch's intake will increase significantly through the fall and into winter for Boundary 1. The specific timing varies by water year type; e.g., during critical and dry years the percentage of Bay water (and salinity) begins to increase in April and remains high (20% to 30%) through January, while during normal and wet water years the percentage of Bay water (and salinity) begins to increase during June and decreases during December (Figure 12). Because water from Martinez is generally much more saline that water from other sources, even a small increase in the fraction of water from Martinez can cause significant increases in the salinity of water at the City's intake. In October of dry years, for example, the fraction of Sacramento River water is simulated to decrease from approximately 85% in Scenario EBC2 and NAA to 62% in scenario Boundary 1 (Figure 10, top right panel), while the fraction of Martinez inflow is simulated to increase from approximately 10% to 30% (Figure 12, top right panel).

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[22] See RDEIS/SDEIS comment packet submitted by the City to WaterFix on December 31, 2015. Attachment A of Exponent's technical review (p. 38 of packet) is titled, "Technical Comments on the BDCP and Associated EIR/EIS, Letter Prepared by Flow Science Incorporated" and includes discussion of DSM2 and its ability to model salinity in the western Delta.

DWR's own fingerprinting analysis for Alternative 4A and Exponent's fingerprinting analysis for the Boundary scenarios show that for much of the year in all water year types, the fraction of Sacramento River water at the City's intake will be lower for Alternative 4A and for operational scenario Boundary 1 than for scenario EBC2, and lower for scenario Boundary 1 than for the NAA. This change in the composition of water at the City's intake is significant, and is caused by the proposed project (both Scenarios Alternative 4A and Boundary 1), not by climate change or sea level rise alone.

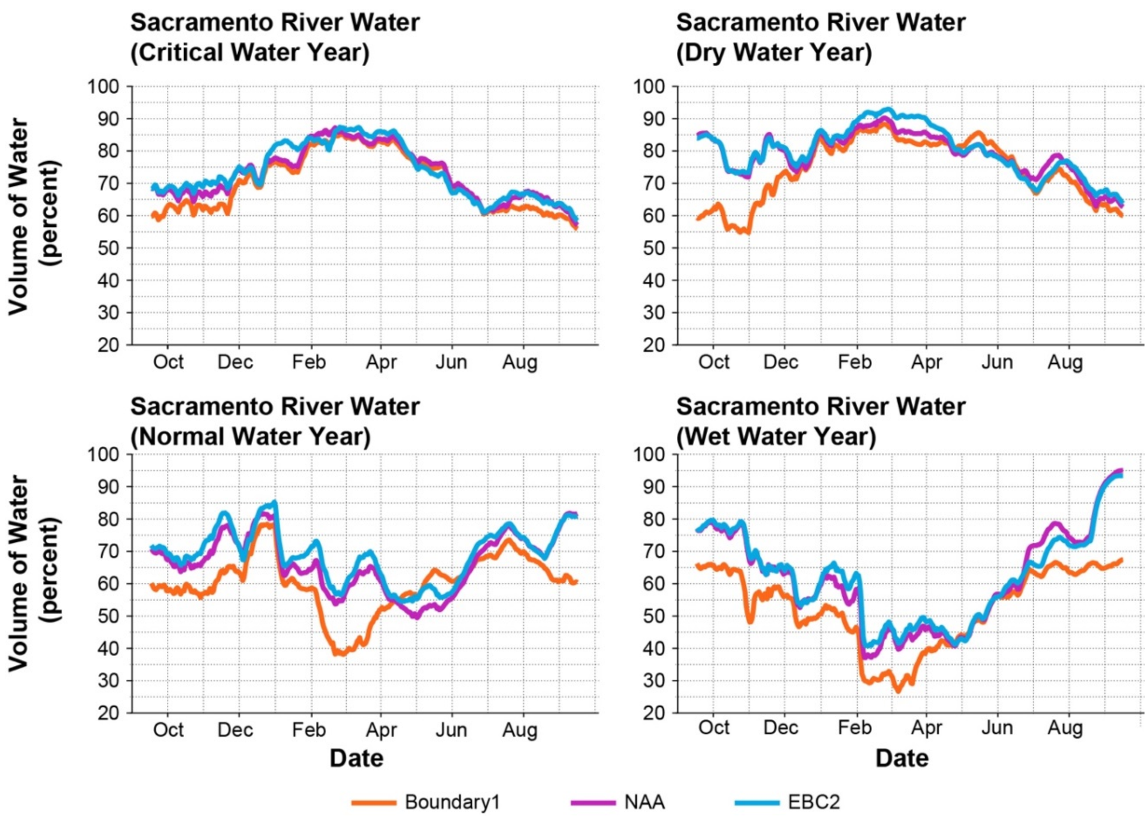

Figure 10. Source fractions of Sacramento River water at Antioch's intake as modeled by DSM2, averaged by water year type. Source water fingerprinting water performed by Exponent using DSM2 and DWR's DSM2 model input files.

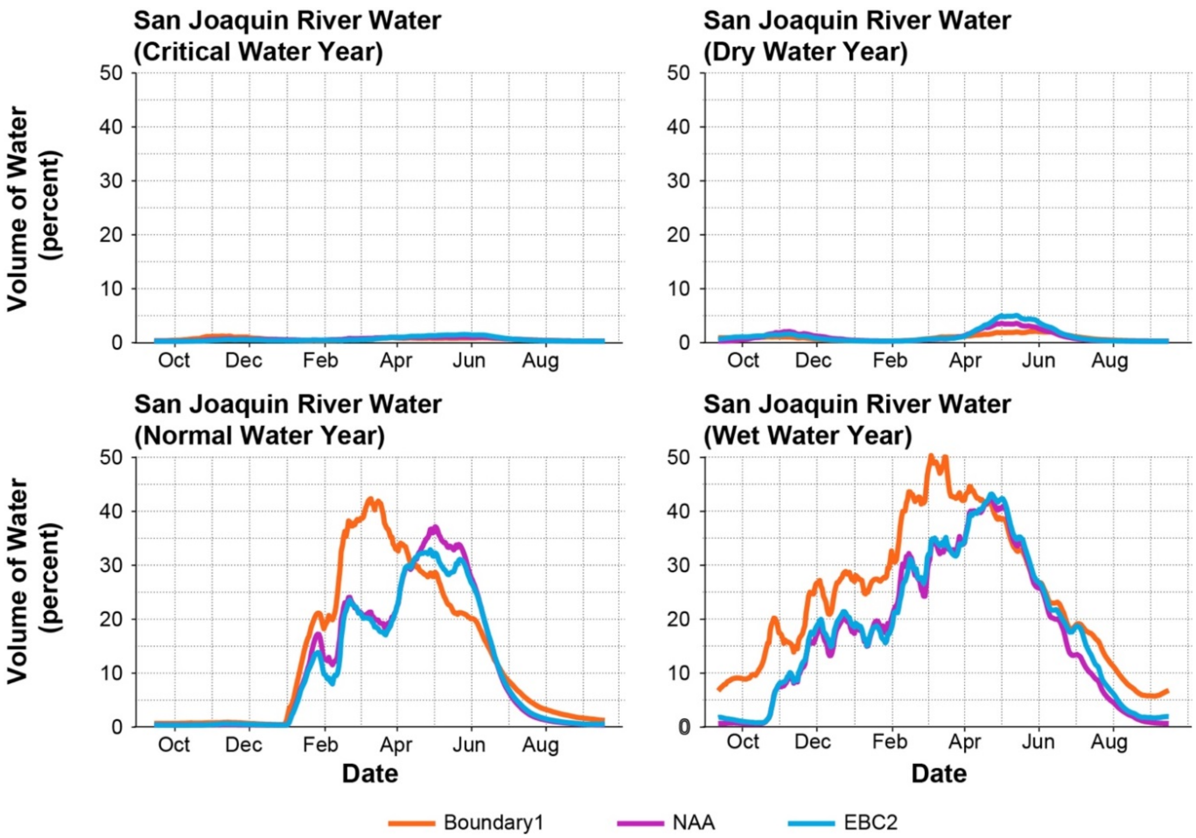

Figure 11. Source fractions of San Joaquin River water at Antioch's intake as modeled by DSM2, averaged by water year type. Source water fingerprinting water performed by Exponent using DSM2 and DWR's DSM2 input files.

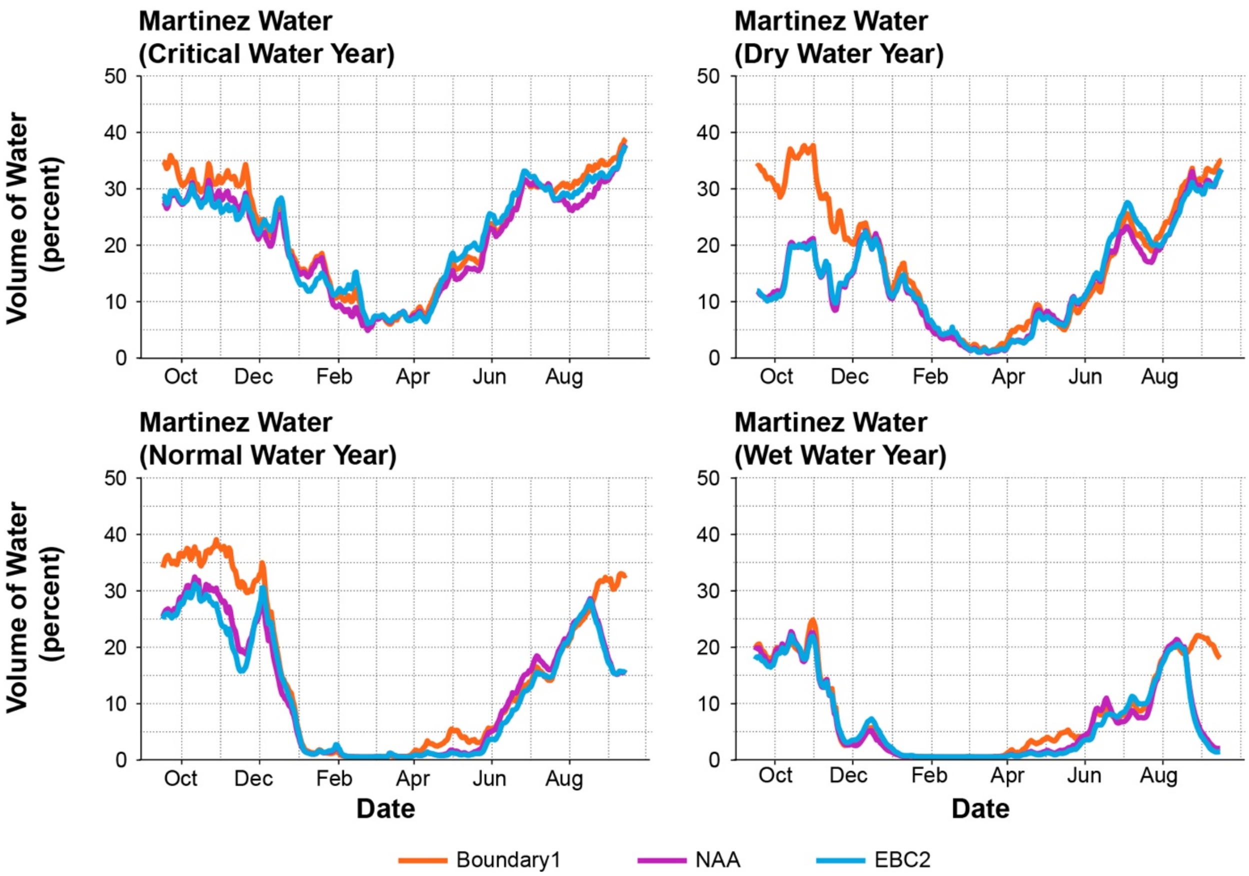

Figure 12. Source fractions of water from Martinez at Antioch's intake as modeled by DSM2, averaged by water year type. Source water fingerprinting water performed by Exponent using DSM2 and DWR's DSM2 input files.

3. The WaterFix Project will result in adverse water quality impacts

3.1. Long-term averages should not be used to evaluate water quality effects or compliance with water quality objectives. By using long-term averages, the FEIR/EIS fails to adequately characterize the impacts of the proposed Project.

Throughout the FEIR/EIS, DWR discusses water quality changes resulting from the proposed operational alternatives as long-term averages. Municipal and industrial water purveyors, such as the City, operate intake facilities and manage water treatment operations to meet consumer demand on short timeframes (e.g., hourly). Model results that are processed to show long-term averages do not provide the information the City needs to assess the impacts of the WaterFix project on the City's drinking water operations. The chloride modeling results presented for Alternative 4A in Appendix 8G are, in DWR's own words, "Period average change in chloride concentrations (mg/L) for Alternative 4A ELT relative to existing conditions and the No Action Alternative ELT,"[23] where the period is the entire 16-year modeled period. DWR calculated these values by averaging in two ways-first, DWR calculated average salinity for each month in the 16-year model simulation period, and second, DWR then averaged the monthly average salinity values for each month in the 16-year period (e.g., results for the 16 Januarys in the 16-year period were averaged). Modeled salinity data representing the Boundary scenarios are not included in in Appendix 8G, and are presented in Appendix 5E of the FEIR/EIS (the same figures presented by DWR during the WaterFix Change Petition Proceedings). The Boundary scenarios are presented as monthly average salinity over the 16-year modeled period as well.

As mentioned above, Appendix 8G of the FEIR/EIS presents chloride modeling results for each of the proposed Alternatives 1-9 as the average change in chloride concentration for each month, averaged over the entire 16-year modeled record ("ALL"), as well as for drought years (i.e., 1987-1991). Figure 13 shows an example of the average modeled change in chloride concentration for Alternative 4A. Results for chloride changes at Antioch's intake are outlined in yellow. The red-colored cells indicate an *increase* in chloride for both the ALL and drought periods in the months of March, April, July, and August. During September of drought years, chloride is also shown to increase by an average of 267 mg/L for Alternative 4A compared to EBC1.[24]

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[23] FEIR/EIS p. 8-150.

[24] Note that the NAA scenario considers 15-cm of sea level rise. Chloride impacts at the City's intake for Alternative 4A scenario are anticipated to be greater compared to the existing conditions scenario EBC2.

Chloride / Alt 4A ELT	Location	Period [a]	OCT		NOV		DEC		JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		Annual Avg. Change	
			Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT
Delta Interior	Moke. R. (SF) at Staten Island	ALL	1	1	1	1	0	0	2	1	1	1	1	1	1	1	0	0	1	1	2	3	2	1	1	1	1	1
			(12%)	(10%)	(9%)	(8%)	(3%)	(4%)	(7%)	(7%)	(5%)	(6%)	(9%)	(7%)	(6%)	(6%)	(2%)	(3%)	(4%)	(4%)	(12%)	(15%)	(11%)	(7%)	(5%)	(4%)	(7%)	(7%)
		DROUGHT	1	1	0	0	0	0	1	1	0	1	1	1	0	0	0	0	0	1	4	4	1	0	0	0	1	1
			(7%)	(6%)	(4%)	(3%)	(-1%)	(1%)	(4%)	(4%)	(2%)	(4%)	(3%)	(5%)	(-0%)	(2%)	(0%)	(2%)	(1%)	(3%)	(23%)	(21%)	(10%)	(-3%)	(3%)	(0%)	(4%)	(4%)
	SJR at Buckley Cove	ALL	-2	0	-2	-1	-5	1	-2	3	-2	1	-2	2	-3	1	-3	1	-7	1	-10	1	-10	1	-5	0	-4	1
			(-3%)	(0%)	(-2%)	(-1%)	(-7%)	(1%)	(-3%)	(3%)	(-3%)	(2%)	(-2%)	(2%)	(-4%)	(2%)	(-4%)	(2%)	(-8%)	(2%)	(-11%)	(1%)	(-11%)	(1%)	(-5%)	(-0%)	(-5%)	(1%)
		DROUGHT	-3	0	-3	0	-9	0	-6	2	-4	2	-3	3	-6	3	-6	3	-13	3	-14	0	-19	2	-7	0	-8	1
			(-3%)	(0%)	(-4%)	(-1%)	(-11%)	(0%)	(-7%)	(3%)	(-5%)	(2%)	(-4%)	(3%)	(-7%)	(4%)	(-7%)	(3%)	(-14%)	(5%)	(-16%)	(0%)	(-19%)	(2%)	(-8%)	(-0%)	(-9%)	(2%)
	Franks Tract	ALL	-103	-64	-212	-158	-93	-60	-31	-41	-7	-8	7	5	7	5	4	3	5	4	-75	-51	-69	-53	-56	-39	-52	-38
			(-35%)	(-25%)	(-56%)	(-48%)	(-31%)	(-23%)	(-20%)	(-25%)	(-12%)	(-14%)	(18%)	(12%)	(18%)	(13%)	(10%)	(7%)	(10%)	(7%)	(-39%)	(-30%)	(-30%)	(-25%)	(-19%)	(-14%)	(-30%)	(-24%)
		DROUGHT	-71	-79	-166	-175	-52	-46	-17	-42	-10	-16	2	-2	3	2	6	2	7	-3	-134	-69	-84	-37	34	19	-40	-39
			(-20%)	(-22%)	(-38%)	(-39%)	(-14%)	(-13%)	(-8%)	(-18%)	(-16%)	(-23%)	(7%)	(-5%)	(15%)	(8%)	(20%)	(4%)	(14%)	(-5%)	(-43%)	(-33%)	(-26%)	(-14%)	(10%)	(5%)	(-19%)	(-18%)
	Old R. at Rock Slough	ALL	-64	-35	-168	-128	-84	-54	-29	-41	-5	-6	7	6	3	2	1	1	8	7	-57	-39	-62	-47	-42	-32	-41	-30
			(-27%)	(-17%)	(-54%)	(-47%)	(-33%)	(-24%)	(-19%)	(-25%)	(-7%)	(-9%)	(15%)	(12%)	(5%)	(3%)	(2%)	(1%)	(15%)	(13%)	(-36%)	(-29%)	(-33%)	(-27%)	(-17%)	(-14%)	(-27%)	(-22%)
		DROUGHT	-34	-40	-136	-151	-49	-42	-13	-42	-10	-16	0	-1	2	1	6	3	7	0	-106	-72	-82	-43	20	12	-33	-33
			(-12%)	(-14%)	(-39%)	(-41%)	(-16%)	(-14%)	(-7%)	(-19%)	(-14%)	(-21%)	(1%)	(-3%)	(6%)	(3%)	(17%)	(10%)	(17%)	(0%)	(-45%)	(-35%)	(-30%)	(-18%)	(7%)	(4%)	(-18%)	(-18%)
Western Delta	Sac. R. at Emmaton	ALL	-218	-181	-213	-130	4	-6	-36	-42	-5	-10	9	1	9	2	1	-1	4	-15	153	127	189	116	50	103	-5	-3
			(-26%)	(-22%)	(-24%)	(-16%)	(1%)	(-1%)	(-24%)	(-26%)	(-9%)	(-14%)	(31%)	(3%)	(22%)	(5%)	(1%)	(-1%)	(2%)	(-6%)	(47%)	(36%)	(40%)	(21%)	(6%)	(13%)	(-1%)	(-1%)
		DROUGHT	-236	-227	-208	-166	63	-5	-51	-83	7	-13	15	1	13	5	27	-5	31	-8	275	230	252	87	262	90	37	-8
			(-21%)	(-20%)	(-17%)	(-14%)	(9%)	(-1%)	(-23%)	(-32%)	(6%)	(-10%)	(34%)	(2%)	(26%)	(8%)	(15%)	(-3%)	(10%)	(-2%)	(59%)	(45%)	(42%)	(11%)	(23%)	(7%)	(7%)	(-1%)
	SJR at Antioch	ALL	-813	-478	-789	-410	-131	-61	-147	-146	-39	-53	26	0	23	5	-3	-7	-12	-57	33	51	182	140	-239	33	-159	-82
			(-37%)	(-25%)	(-32%)	(-20%)	(-9%)	(-4%)	(-24%)	(-24%)	(-15%)	(-19%)	(23%)	(0%)	(16%)	(3%)	(-1%)	(-2%)	(-2%)	(-9%)	(3%)	(4%)	(12%)	(9%)	(-11%)	(2%)	(-15%)	(-8%)
		DROUGHT	-748	-563	-682	-344	-34	-45	-170	-215	-8	-74	43	-1	37	14	27	-21	17	-46	80	103	308	247	267	117	-72	-69
			(-26%)	(-23%)	(-22%)	(-13%)	(-2%)	(-2%)	(-20%)	(-24%)	(-2%)	(-16%)	(26%)	(-0%)	(19%)	(6%)	(5%)	(-3%)	(2%)	(-5%)	(5%)	(6%)	(18%)	(14%)	(10%)	(4%)	(-5%)	(-5%)
	Sac. R. at Mallard Island	ALL	-826	-358	-763	-264	-139	-51	-215	-199	-22	-60	77	16	52	12	8	-16	-5	-113	162	180	321	230	-363	108	-143	-43
			(-18%)	(-9%)	(-16%)	(-6%)	(-4%)	(-2%)	(-13%)	(-12%)	(-2%)	(-6%)	(17%)	(3%)	(7%)	(1%)	(1%)	(-1%)	(-0%)	(-6%)	(5%)	(6%)	(9%)	(7%)	(-9%)	(3%)	(-6%)	(-2%)
		DROUGHT	-833	-405	-807	-226	-79	-44	-310	-330	36	-96	104	36	79	35	1	-32	-1	-47	191	229	387	264	223	102	-84	-43
			(-16%)	(-8%)	(-13%)	(-4%)	(-2%)	(-1%)	(-13%)	(-13%)	(2%)	(-6%)	(15%)	(5%)	(7%)	(3%)	(0%)	(-1%)	(-0%)	(-2%)	(5%)	(6%)	(10%)	(7%)	(5%)	(2%)	(-3%)	(-1%)

Figure 13. Period average change in chloride concentrations (mg/L) for Alternative 4A ELT relative to existing conditions and the NAA ELT scenario. Calculation of chloride concentrations was based on the mass balance approach.[25]

[25] FEIR/EIS p. 8G-9. For a discussion of DWR's mass balance approach to chloride concentration calculation, see FEIR/EIS p. 8-150.

To illustrate how monthly or 16-year averages obscure water quality impacts, it is useful to plot daily average salinity simulated by DWR using DSM2. Figure 14 shows daily average chloride concentrations simulated at Contra Costa Pumping Plant #1, one of the compliance locations specified in the D-1641 water quality objectives, for WY 1978 and WY 1979, and shows that a threshold concentration of 250 mg/L chloride is exceeded for Scenarios NAA and Boundary 1 from early October 1977 through early January 1978, and again for the Boundary 1 scenario from late December through the end of February of 1979. The existing condition (EBC2) scenario exceeds the 250 mg/L chloride for a few days in early January 1977 as well but not during the remainder of the time period. Figure 14 also shows daily average chloride concentrations from the 16-year period superimposed on the long-term monthly average concentrations presented by DWR.[26] Clearly, model results averaged both by month and over a 16-year period are significantly different from simulated *daily* chloride concentrations. Perhaps more importantly, information critical to the City's intake operations (e.g., the period of time that salinity exceeds 250 mg/L) is hidden in long-term averages.

Although the long-term average salinity data presented in the FEIR/EIS indicate that the City can expect to experience long-term adverse water quality impacts as a result of the WaterFix project, the information in the FEIR/EIS does not include the level of detail required for the City to plan adjustments to their intake operations, or to evaluate compliance with *daily* salinity criteria for the Delta.

[26] See Section 5d of Attachment 2A for additional information on DWR's inappropriate use of long-term average chloride data.

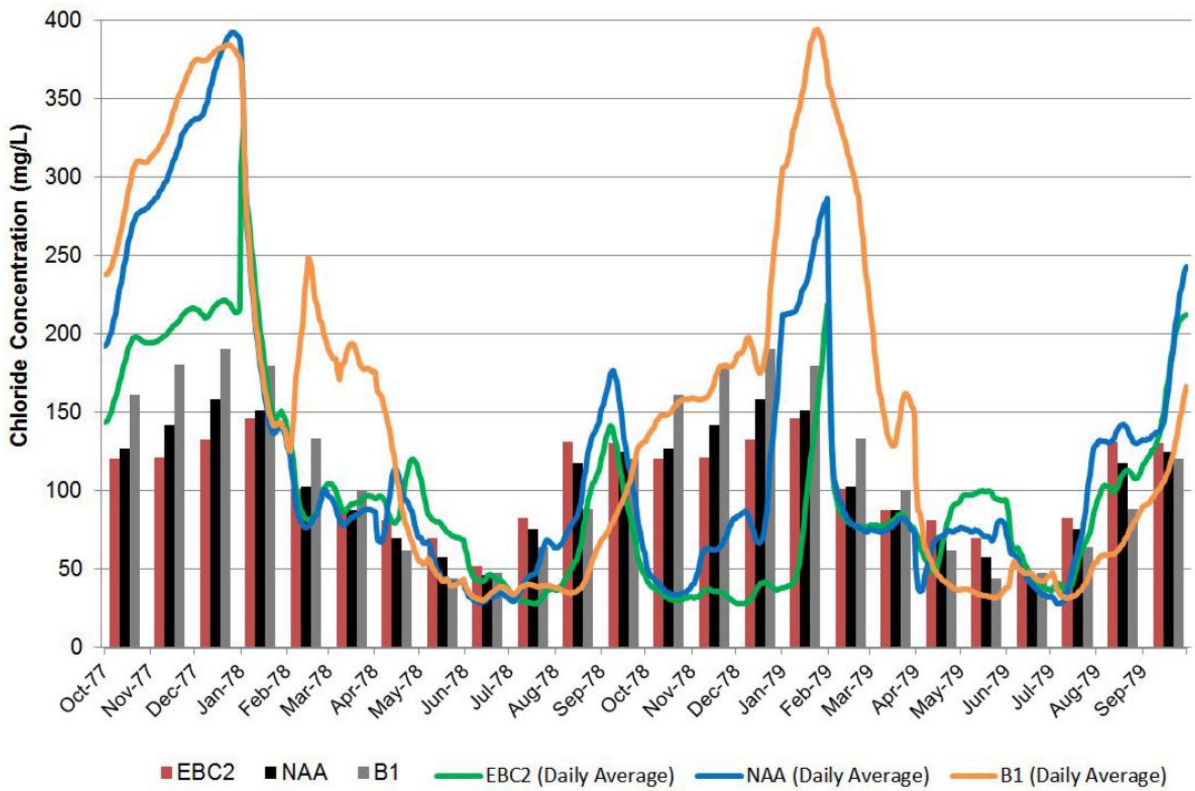

Figure 14. Daily average chloride concentrations at Contra Costa Pumping Plant #1 (CCPP#1) for WY 1978-WY 1979 superimposed on the monthly averaged data for the 16-year modeled period. The bars describing 16-year average salinity were repeated for each month in WY 1978 and 1979.

3.2. Compliance with D-1641 250 mg/L Chloride Water Quality Objective will occur less frequently under scenario Boundary 1

The WaterFix Project would export more water from the Delta than occurs under existing conditions (exports would increase significantly under scenarios H3 and Boundary 1), and because the WaterFix Project would increase both the amount and proportion of high water quality Sacramento River flows removed from the system, implementation of the proposed WaterFix Project is expected to make compliance with water quality criteria even more challenging. Because DWR has stated that they may operate the WaterFix project to the Boundary scenarios (see Section 2.1), the Boundary 1 scenario remains the primary focal point of Exponent's impact evaluations.

DWR's model results show that compliance with the D-1641 250 mg/L chloride water quality objective at CCPP#1, as calculated by "maximum mean daily" chloride, is challenging under both the existing conditions (EBC2) and the future no project (NAA) scenarios. Model results show that compliance will occur even less frequently under Scenario Boundary 1. Thus, DWR's own model results do not appear to support DWR's testimony that increased operations flexibility will result in greater compliance with water quality objectives in the future.

The number of days the threshold of 250 mg/L chloride is not met at CCPP#1 for each year in the 16-year modeled record is shown in Table 4. Significant variability exists from year to year between the different scenarios; however, the Boundary 1 scenario exceeds the threshold value more frequently than other project scenarios than both the existing condition and the NAA. In the dry year of 1989, for example, the Boundary 1 scenario exceeds the threshold for 124 days that year, and during the critical water year of 1991 the threshold is exceeded 117 days by the Boundary 1 scenario. In contrast, the existing condition is simulated to exceed this threshold only 77 and 76 days in 1989 and 1991, respectively.

The data from Table 4 are aggregated in Table 5 by water year type. While the year to year variability is muted some by the aggregation, several general trends are clear. During dry and "normal" (i.e., above normal and below normal) water years and for Scenario Boundary 1, the 250 mg/L chloride threshold is exceeded at CCPP#1 46 and 71 days per year, respectively (Table 5). For critical water years, NAA exceeds the 250 mg/L chloride threshold most often with an average of 44 days; the existing conditions (EBC2) scenario exceeds the threshold most often during wet years.

Table 4 Number of days in each water year that the D-1641 WQO of 250 mg/L chloride for Municipal and Industrial Beneficial Uses at CCPP#1 is not met, based on DWR model results.

Water Year	Water Year Type	Total Days	Number of Days 250 mg/L Chloride Threshold is Not Met at CCPP#1		
			EBC2[b]	NAA[a]	Boundary 1[a]
1976	Critical	366	37	0	0
1977	Critical	365	8	50	16
1978	Normal	365	10	87	105
1979	Normal	365	0	17	64
1980	Normal	366	87	57	44
1981	Dry	365	0	0	0
1982	Wet	365	3	12	10
1983	Wet	365	34	0	0
1984	Wet	366	0	0	0
1985	Dry	365	0	0	15
1986	Wet	365	23	26	6
1987	Dry	365	0	0	46
1988	Critical	366	1	4	14
1989	Dry	365	77	106	124
1990	Critical	365	40	60	25
1991	Critical	365	76	107	117
		Sum	396	526	586

[a] WaterFix model runs (05/2016)
[b] EIR/EIS model run EBC2 (2013), the existing condition model run most representative of current conditions

Table 5 Average days per year by water year type that the D-1641 250 mg/L chloride WQO for Municipal and Industrial Beneficial Uses at CCPP#1 is not met, based on DWR model results.

	Average Number of Days 250 mg/L Chloride Threshold is Not Met at CCPP#1		
Water Year Type	**EBC2[b]**	**NAA[a]**	**Boundary 1[a]**
Critical	32	44	34
Dry	19	27	46
Normal	32	54	71
Wet	15	10	4
Average	25	33	37

[a] WaterFix model runs (05/2016)
[b] EIR/EIS model run EBC2 (2013), the existing condition model run most representative of current conditions

3.3. The D-1641 150 mg/L Water Quality Objective will not be met at Antioch.

D-1641 includes water quality objectives for municipal and industrial (M&I) beneficial uses of 150 mg/L to be met at either CCPP#1 or at the City's intake, which is located in the San Joaquin River channel. D-1641 specifies that the "maximum mean daily" chloride concentration of 150 mg/L must be met for a specific number of days during the calendar year to be provided in "intervals of not less than two weeks duration"; this requirement must be met at either CCPP#1 or at Antioch's intake (see Table 6). DSM2 output was used to calculate the number of days per calendar year that the maximum daily chloride concentration at Antioch Water Works Intake is simulated to be below 150 mg/L, considering the requirement that the number of days be met in intervals of not less than two weeks duration. Although DWR does not assess compliance at the City's intake location, where water quality is more likely to be influenced by more saline water from the Bay, it is instructive to evaluate salinity at this location, as it is indicative of saltwater intrusion to the Delta.

Table 6. Water quality objectives (WQOs) for municipal and industrial beneficial uses as specified in D-1641.

Compliance Location	Parameter	Description	Water Year Type	Time Period	Value
Contra Costa Canal at Pumping Plant #1 **or** San Joaquin River at Antioch Water Works Intake	Chloride (Cl-)	Maximum mean daily 150 mg/L Cl- for at least the number of days shown during the Calendar Year [in the "Value" column]. Must be provided in intervals of not less than two weeks duration.	W	--	240 days
			AN	--	190 days
			BN	--	175 days
			D	--	165 days
			C	--	155 days
Contra Costa Canal at Pumping Plant #1, **and** West Canal at Mouth of Clifton Court Forebay, **and** Delta-Mendota Canal at Tracy Pumping Plant, **and** Baker Slough at North Bay Aqueduct Intake, **and** Cache Slough at City of Vallejo Intake	Chloride (Cl-)	Maximum mean daily (mg/L)	All	Oct-Sep	250 mg/L Cl-

As shown in Table 7, simulated chloride concentrations at the City's intake routinely exceed the 150 mg/L threshold for M&I beneficial uses. During wet years, water quality objectives, expressed as a certain number of days (dependent on the year type), are met occasionally at the City for the existing condition (EBC2). The Boundary 1 and NAA scenarios are predicted to meet water quality objectives only during the single wettest year in the 16-year period. For critical, dry, and above- and below-normal years (normal years), water quality at the City's intake does not meet the 150 mg/L threshold as specified in D-1641 for scenarios Boundary 1, NAA, or EBC2.

Even at the CCPP#1, DWR's modeling shows that complying with the D-1641 M&I objectives is challenging (see Table 8); compliance is expected to decline in the future under both the NAA and Boundary 1 scenarios relative to existing conditions (EBC2). Table 8 presents the results of the 150 mg/L threshold analysis for the CCPP#1 location. WQOs are <u>not</u> met during two of the five critical water years in the 16-year model period for the Boundary 1 and NAA scenarios, and WQOs are not met for one of the five critical water years under EBC2 scenario.

Table 9 presents the number of days in each year that chloride concentrations at CCPP#1 are predicted to be below the threshold of 150 mg/L chloride (and that occur in no less than two-week periods). For some years that are anticipated to comply with the 150 mg/L chloride WQO, the total number of days below the threshold, as counted in two-week consecutive intervals (as specified in D-1641), decreases significantly in certain years. During WY 1979, for example, Scenario Boundary 1 has 160 fewer days with a chloride concentration below 150 mg/L than the existing condition (EBC2), yet the benchmark of 175 days met for that year by both scenarios. Similarly, in WY 1981, Scenario Boundary 1 has 34 fewer days below the 150 mg/L threshold than the existing condition (EBC2), but both years remain above the benchmark of 165 days. Thus, in both WY1979 and WY1981 at CCPP#1, water quality is degraded significantly for Scenario Boundary 1 as compared to existing conditions (EBC2), even though water quality objectives are met in both years.

Table 7 Number of years in the 16-year modeled record that the D-1641 WQO of 150 mg/L chloride for Municipal and Industrial Beneficial Uses is met at Antioch Water Works Intake, averaged by water year type, and based on DWR model results.[27]

		Number of Years 150 mg/L Chloride Threshold is Met at Antioch Water Works Intake		
Water Year Type	**Total Years in Each Water Year Type**	**EBC2[b]**	**NAA[a]**	**Boundary 1[a]**
Critical	5	0	0	0
Dry	4	0	0	0
Normal	3	0	0	0
Wet	4	3	1	1

[a] WaterFix model runs (05/2016)
[b] EIR/EIS model run EBC2 (2013), the existing condition model run most representative of current conditions

[27] The 150 mg/L threshold is evaluated on a calendar year basis, thus data were sorted by dominant water year classification and averaged for this analysis.

Table 8 Number of years in the 16-year modeled record that the D-1641 WQO of 150 mg/L chloride for Municipal and Industrial Beneficial Uses is met at CCPP#1, averaged by water year type, and based on DWR model results.

Water Year Type	Total Years in Each Water Year Type	Number of Years 150 mg/L Chloride Threshold is Met at CCPP#1		
		EBC2[b]	NAA[a]	Boundary 1[a]
Critical	5	4	3	3
Dry	4	4	3	4
Normal	3	2	3	3
Wet	4	3	3	4

[a] WaterFix model runs (05/2016)
[b] EIR/EIS model run EBC2 (2013), the existing condition model run most representative of current conditions

Table 9 Number of days per year in the 16-year modeled record that the D-1641 WQO of 150 mg/L chloride for Municipal and Industrial Beneficial Uses is met at CCPP#1 based on DWR model results. Bold numbers in gray cells indicate that the threshold criteria were not met.

Water Year	Threshold Criteria (days)	Number of Days 150 mg/L Chloride Threshold is Met at CCPP#1		
		EBC2 (days)	NAA (days)	Boundary 1 (days)
1976	155	291	366	301
1977	155	156	**145**	**112**
1978	190	243	239	**188**
1979	175	338	311	178
1980	190	**187**	202	242
1981	165	289	281	255
1982	240	299	298	287
1983	240	298	337	365
1984	240	366	357	366
1985	165	310	361	298
1986	240	**213**	**235**	254
1987	165	300	365	257
1988	155	217	263	250
1989	165	186	**159**	209
1990	155	164	165	168
1991	155	159	**132**	**138**

3.4. The WaterFix Project will degrade water quality at Antioch's intake and reduce the number of usable water days

DWR entered into an Agreement with the City in 1968 to compensate the City for water it must purchase as a result of declining water quality at its intake as caused by the SWP. That agreement defined water as "usable" when the chloride concentration at the City's intake on the San Joaquin River channel is less than 250 mg/L as measured at slack current after higher high tide (HHT). When the terms of the 1968 Agreement was amended in 2013 through September 30, 2028, the Amendment clarified that "slack current after higher high tide" occurs approximately two hours after HHT.

DWR's simulated EC concentrations were converted to chloride concentrations using the salinity conversion methods[28] described in Attachment 2A for the proposed scenarios NAA, EBC2, and Boundary 1, in order to evaluate water quality impacts to the City's water supply under the WaterFix Project. Exponent used DWR's model results to calculate chloride concentrations at the City's intake two hours after HHT (see Attachment 2A Section 3.5) and to calculate the number of days that the chloride concentration at slack current following HHT is predicted to exceed 250 mg/L. Model results were also used to calculate the monthly average chloride concentration for each model scenario and for each year type classification.

The general increase in simulated chloride levels is shown in Table 10, which presents the *change* in monthly average values of the daily chloride concentration at slack current following HHT at the City's intake for the Boundary 1 scenario relative to existing conditions (EBC2). As shown in Table 10, positive values indicate an *increase* in chloride concentrations (averaging concentrations for each day at slack current after HHT). Of the 48 entries, all but two are positive, indicating an increase in chloride concentrations for Scenario Boundary 1 relative to existing conditions. In 29 of the 48 entries in Table 10, the increase in the chloride concentration (averaging concentrations for each day at slack current after HHT) is between 100 and 1000 mg/L, and in five of the entries, the increase in the chloride concentration (averaged as described above) is greater than 1000 mg/L. The increase in chloride concentrations (for Scenario Boundary 1 relative to existing conditions EBC2) is greatest during the summer and fall months.

DWR's model results were also used to compute the number of days per year that water at the City's intake is "usable," consistent with the 1968 Agreement as detailed in Attachment 2A Section 3.5. As shown in Table 11, the number of days in which water is not usable is greater under the Boundary 1 scenario than under current conditions (EBC2) for all water years with the exception of water year 1977, which had no usable days under any scenario. Table 12 aggregates the results in Table 11 by year type and shows that the usability of water at the City's intake decreases in all year types for scenario Boundary 1 relative to existing conditions. The loss in terms of days of usable water is shown in Table 13 and is greatest in wet and normal year types. These results indicate that the implementation of the Boundary 1 scenario will impact water quality at the City's intake more during normal and wet years than during dry and critical

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[28] See Attachment 2A Section 3.2 for methods used for salinity and bromide calculations.

years. Figure 15 further illustrates these impacts, showing simulated daily chloride concentrations at slack current after HHT as averaged over "normal" years (1978–1980); as shown in this figure, chloride concentrations are predicted to increase for Scenario Boundary 1 relative to existing conditions in all months except portions of January, February, and March, and water that would have been usable under existing conditions exceeds the usability threshold of 250 mg/L for Scenario Boundary 1 during portions of April, May, and June.

The Boundary 1 scenario is shown to result in increased chloride concentrations at the City's intake on average for all water year types compared to both the NAA and EBC2 scenarios, indicating that impacts result from project operations and not from sea level rise or climate change impacts alone. The increase in chloride will decrease the number of useable water days at the City's intake, requiring them to purchase water with higher frequency.

Table 10 Difference in monthly average chloride concentration (mg/L) at Antioch's intake at slack current after HHT for Scenario Boundary 1 relative to existing conditions (EBC2). Positive numbers indicate an increase in chloride concentrations for Scenario Boundary 1 relative to existing conditions (EBC2).

	Difference in Chloride Concentration (mg/L) between Boundary 1 and EBC2 at Antioch			
	Wet WY	Normal WY	Dry WY	Critical WY
Jan	-2	149	408	380
Feb	4	9	97	132
Mar	1	9	46	37
Apr	27	52	114	113
May	187	214	123	34
Jun	205	257	8	-15
Jul	153	347	121	249
Aug	272	359	453	381
Sep	1395	1304	548	339
Oct	333	969	1895	608
Nov	223	1381	1596	638
Dec	12	901	819	410

Table 11 Number of days per year when water is not usable at the City's intake (i.e., when that the chloride concentration at Antioch's intake is greater than 250 mg/L at slack current after HHT), calculated from DWR simulation results.

		Number of Days Chloride > 250 mg/L		
Water Year	**Water Year Type**	**EBC2[b]**	**NAA[a]**	**Boundary 1[a]**
1976	critical	332	340	361
1977	critical	365	365	365
1978	normal	204	200	206
1979	normal	220	220	261
1980	normal	206	192	226
1981	dry	280	268	291
1982	wet	140	118	162
1983	wet	45	0	65
1984	wet	131	114	180
1985	dry	270	280	326
1986	wet	209	202	239
1987	dry	286	297	311
1988	critical	306	325	331
1989	dry	291	288	299
1990	critical	356	341	357
1991	critical	325	326	326
	Sum	**3966**	**3876**	**4306**

[a] WaterFix model runs (05/2016)
[b] EIR/EIS model run EBC2 (2013), the existing condition model run most representative of current conditions

Table 12 Average number of days per year in each year type when water is not usable at the City's intake (i.e., when that the chloride concentration at Antioch's intake is greater than 250 mg/L at slack current after HHT), calculated from DWR simulation results.

	Average Number of Days Chloride > 250 mg/L		
Water Year Type	**EBC2[b]**	**NAA[a]**	**Boundary 1[a]**
Wet	131	109	162
Normal	210	204	231
Dry	282	283	307
Critical	337	339	348

[a] WaterFix model runs (05/2016)
[b] EIR/EIS model run EBC2 (2013), the existing condition model run most representative of current conditions

Table 13 Decrease in number of days of water usability at Antioch's intake, averaged by water year type, compared to existing conditions.

	Number of Lost Usable Water Days Relative to EBC2	
Water Year Type	**NAA[a]**	**Boundary 1[a]**
Wet	22	31
Normal	6	21
Dry	-1	25
Critical	-2	11

[a] WaterFix model runs (05/2016)

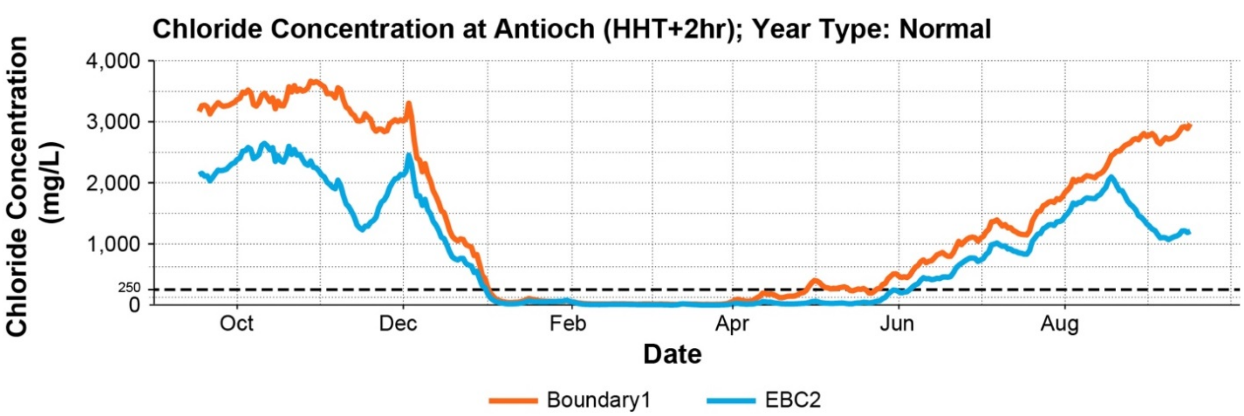

Figure 15 Daily chloride concentrations in water at Antioch's intake location as modeled by DSM2 (at slack current after HHT) and averaged for each day for normal water years.

3.5. Increased salinity will impact the City's operations

The modeled salinity at the City's intake shows that the City can expect significant impacts to the City's diversion and treatment operations. Implementation of the WaterFix Project, particularly under Scenario Boundary 1, is simulated to lead to significant water quality degradation. Currently, the City diverts water at its intake to the City's treatment facility if the chloride concentration is less than 250 mg/L. As shown in Table 11, water would be "usable" at the City's intake for fewer days under the Boundary 1 scenario relative to existing conditions (EBC2) and relative to the NAA scenario. During water year 1985 (dry water year), the City would lose 56 usable water days (almost two months) under Boundary 1 scenario compared to EBC2. As summarized in Table 13, the City would lose an average of 31, 25, or 21 days of useable water during wet, dry, and normal water years, respectively, under the Boundary 1 scenario relative to existing conditions (EBC2).

In summary, DWR's model results show that the WaterFix project will increase the frequency of exceedance of water quality objectives for M&I beneficial uses, and will increase salinity at the City's intake. By comparing project results with the NAA, we see that much of this impact is due to the implementation of the proposed project, and not due to climate change and sea level rise.

4. The Adaptive Management and Monitoring Program remains undefined, and it is not possible to ascertain impacts to the City without understanding how the WaterFix project will be operated

The Adaptive Management and Monitoring Program (AMMP) remains undefined in the FEIR/EIS, which offers only a broad description of program objectives and the program's conceptual framework.[29] In addition, DWR states in the FEIR/EIS that "detailed monitoring and research plans will be developed that identify specific metrics and protocols"[30]. In a September 2016 document describing the AMMP framework for WaterFix, DWR states that "many actions [of the current BiOps] do not contain measureable objectives needed for the design and planning of an adaptive management program."[31]

The descriptions of the AMMP throughout the FEIR/EIS are similarly ambiguous, such that changes in project operations over time, and the criteria or decision points that will be used to

29 "Collaborative science and adaptive management will support the proposed project by helping to address scientific uncertainty where it exists, and as it relates to the benefits and impacts of the construction and operations of the new water conveyance facility and existing CVP and SWP facilities. Specifically, collaborative science and adaptive management will, as appropriate, develop and use new information and insight gained during the course of project construction and operation to fulfill 5 primary objectives: 1) Inform and improve on the design of fish facilities including the intake fish screens; the operation of the water conveyance facilities under the Section 7 biological opinion and 2081b permit; and habitat restoration and other mitigation measures conducted under the biological opinions and 2081b permits. 2) Ensure the ongoing SWP/CVP operations and future construction and operation of the CWF are implemented in a way that reflects the current state of scientific understanding and improves the viability of the species to the extent possible. 3) Maintain and improve water supply reliability, to the extent possible. 4) Communicate (provide transparency) to the broader community of state, federal and local agencies, the public, universities, scientific investigators, public water agencies and nongovernment stakeholders how existing operations will be assessed, how new scientific investigations will be prioritized, and carried out, and how the results of those investigations will be integrated into adaptive management decisions. 5) Build on and support existing efforts of the Interagency Ecological Program, Collaborative Science and Adaptive Management Program, Delta Stewardship Council/Delta Science Program, and other relevant individual agency science initiatives." FEIR/EIS p. 3-281/282

30 FEIR/EIS p. 3-26.

31 See Attachment 6A, p. 14: DWR (2016). Adaptive Management Framework for the California WaterFix and Current Biological Opinions on the coordinated operations of the Central Valley and State Water Projects. Draft Document dated 072116, released September 28, 2016. Downloaded from http://cms.capitoltechsolutions.com/ClientData/CaliforniaWaterFix/uploads/FIX_eBlast_AdaptiveMgmt_92816_V2.pdf).

adjust project operations over time are wholly unclear. For example, at p. 3-283 of the FEIR, DWR states that "Under the current BiOps and future operations under California WaterFix, a "real-time operations" (RTO) mechanism will allow for adjustments of water operations, within established conditions… to benefit covered fish species" (emphasis added). In the RDEIR/SDEIS[32], the BA[33], and the FEIR/EIS, discussion of the AMMP indicates that adjustments in project operations will be made to protect fish; we have found no indication in these documents that the AMMP will be operated to protect water quality for municipal and industrial beneficial uses.

In addition, the proposed WaterFix operations that will serve as a starting point for the AMMP are loosely defined, and "adjustments of water operations" or boundaries of "established conditions," as quoted above, remain largely undefined. In short, the impacts of the WaterFix project on water quality in Delta cannot be determined, and there are no metrics, standards, or boundaries in place that would limit impacts to municipal and industrial beneficial uses or provide means for mitigating adverse water quality impacts that DWR's modeling indicates will occur as a result of the proposed WaterFix project. Even worse, DWR appears to indicate that the AMMP may also serve as a means to change WaterFix operations beyond permitted limits:

> *"The collaborative science effort is expected to inform operational decisions within the ranges established by the biological opinion and 2081b permit for the proposed project. However, if new science suggests that operational changes may be appropriate that fall outside of the operational ranges evaluated in the biological opinion and authorized by the 2081b permit, the appropriate agencies will determine, within their respective authorities, whether those changes should be implemented."*[34]

DWR has not, to our knowledge, indicated who the "appropriate agencies" might be and what are or will be the limits of their "respective authorities." DWR has not indicated, to our knowledge, the "new science" (or even the type of "new science") that may influence the "appropriate agencies" to change operations beyond permit limits. In addition, it is unclear whether the Boundary scenarios evaluated by DWR for the WaterFix Change Petition Proceedings represent "bookends" for proposed operations, or whether future operations may fall outside of the range represented by Boundary 1 and Boundary 2.

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32 "…collaborative science and adaptive management will, as appropriate, develop and use new information and insight gained during the course of project construction and operation to inform and improve… the operation of the water conveyance facilities under the Section 7 biological opinion and 2081b permit…" RDEIR/SDEIS at p. 4.1-18.

33 "…collaborative science and adaptive management will, as appropriate, develop and use new information and insight gained during the course of construction and operation of the PA [preferred alternative] to inform and improve the following aspects of the California WaterFix program…Design of fish facilities including the intake fish screens… Operation of the water conveyance facilities under the BiOps and 2081(b) permit… Habitat restoration and other mitigation measures conducted under the BiOps and 2081(b) permit" January 2016 Draft BA Section 3.4.7 p. 3-191.

34 FEIR/EIS p. 3-287

Adding to the confusion surrounding the AMMP, DWR states that "the adaptive management and monitoring program is directly related to several key components of the BDCP"[35], but fails to identify which "key components" are referenced. Exponent has commented on past BDCP documentation regarding the AMMP[36]; full details of our prior comments can be found in Attachment 2A, Section 5c.

In contrast, the requirements of an adaptive management program have been studied and defined on multiple occasions. In February 2009, the Independent Science Advisors issues a report entitled "Bay Delta Conservation Plan Independent Science Advisors' Report on Adaptive Management."[37] The report summarizes the Independent Science Advisors' "recommended framework for incorporating adaptive management into the planning, design, and implementation of the BDCP." The science advisors recommend "more extensive and explicit use of models to formalize knowledge about the system and to select, design, and predict outcomes of conservation measures"; the advisors also recommended that "greater attention be given to the learning value of actions, and to establishing a formal process by which new knowledge is used to alter actions or revise goals or objectives."[38] The report proposed a formal framework, reproduced below as Figure 16, and noted that:

> *"The weakest aspect of most adaptive management plans is in the sequence of steps required to link the knowledge gained from implementation and other sources to decisions about whether to continue, modify, or stop actions, refine objectives, or alter monitoring. This step must be much more fully developed than was evident in the BDCP documents we reviewed. Responsibility for this step should be assigned to a highly skilled agent (person, team, office) having the right mix of policy and technical*

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35 FEIR/EIS p. 3-26.

36 Exponent has commented that the "RDEIR/SDEIS proposed project Alternative 4A relies heavily on the AMMP to dictate changes in operation of water conveyance facilities, habitat restoration, and other factors during project construction and operation. The AMMP is a central component of the WaterFix Project yet remains almost wholly undefined. Beyond an introduction to basic principles of adaptive management, there is little discussion in the RDEIR/SDEIS of how the AMMP will be implemented, nor does it appear that there will be a review process for the considerable changes that may be recommended as a result of the AMMP. Although the AMMP is described as a means of making adjustments to operations criteria, there is no discussion of how this iterative process will occur. In addition, no operational boundaries are defined with regard to potential application of the AMMP that would operate to reduce increased salinity caused by WaterFix and the operations of the State and Federal Projects. Presumably, the AMMP would allow operations consistent with the B1 operating scenario; as detailed in these comments, operating to Scenario B1 operations criteria would result in significant increases in salinity at the City." Attachment 2A, p. 24-25

37 Bay Delta Conservation Plan Independent Science Advisors' Report on Adaptive Management. Prepared for the BDCP Steering Committee. February 2009. Available at http://baydeltaconservationplan.com/Libraries/Dynamic_Document_Library/Independent_Science_Advisors_Report_on_Adaptive_Management_-_Final_2-1-09.sflb.ashx.

38 Ibid at p. ii.

expertise. This investment is critical to making adaptive management effectively support the BDCP."[39]

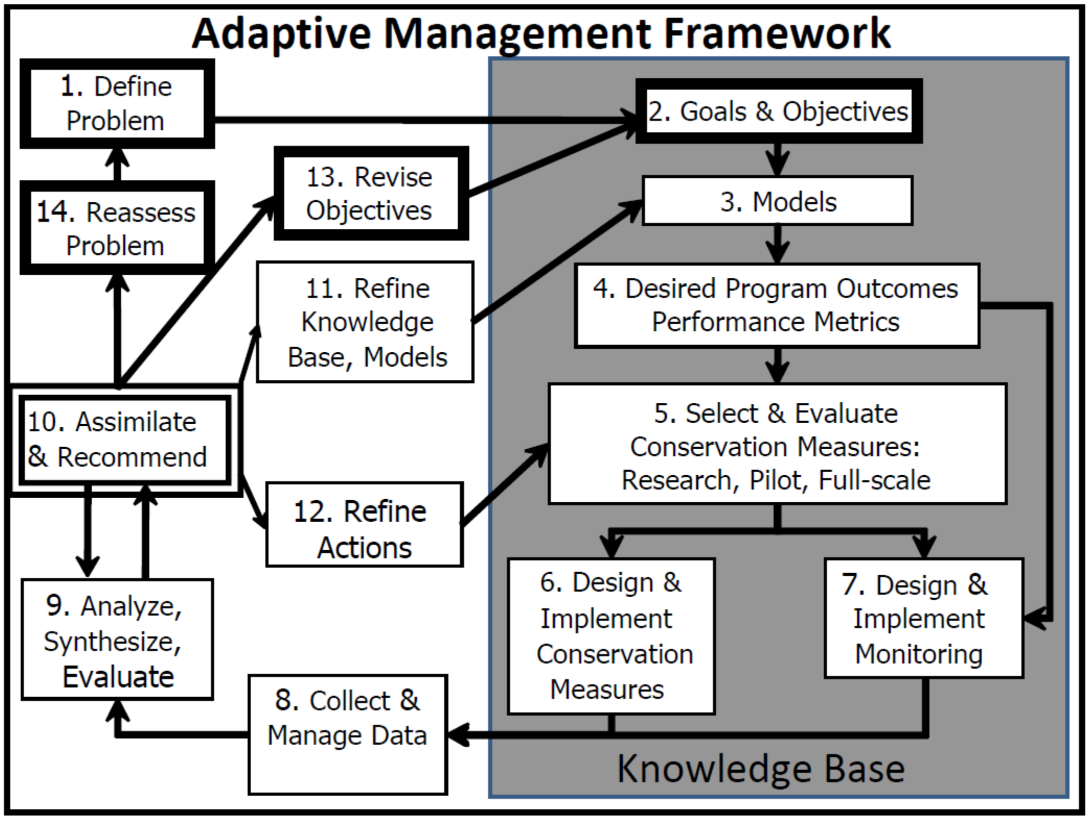

Figure 16. A recommended AMP framework for BDCP showing the flow of information and responsibilities of different entities. Reproduced from Figure 1 of Bay Delta Conservation Plan Independent Science Advisors' Report on Adaptive Management (2009).[37]

The Delta Plan issued in 2013 also included an appendix entitled "Adaptive Management and the Delta Plan."[40] This document described adaptive management, as defined in the Delta Reform Act, as "a framework and flexible decision-making process for ongoing knowledge acquisition, monitoring, and evaluation leading to continuous improvements in management planning and implementation of a project to achieve specified objectives (Water Code section

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[39] Ibid at p. iv.

[40] Delta Stewardship Council (2013). The Delta Plan. Appendix C: Adaptive Management and the Delta Plan Available at http://deltacouncil.ca.gov/sites/default/files/documents/files/AppC_Adaptive%20Management_2013.pdf

85052)."[41] The document identified a "three-phase and nine-step" adaptive management framework; the nine-step adaptive management framework is reproduced as Figure 17 below.

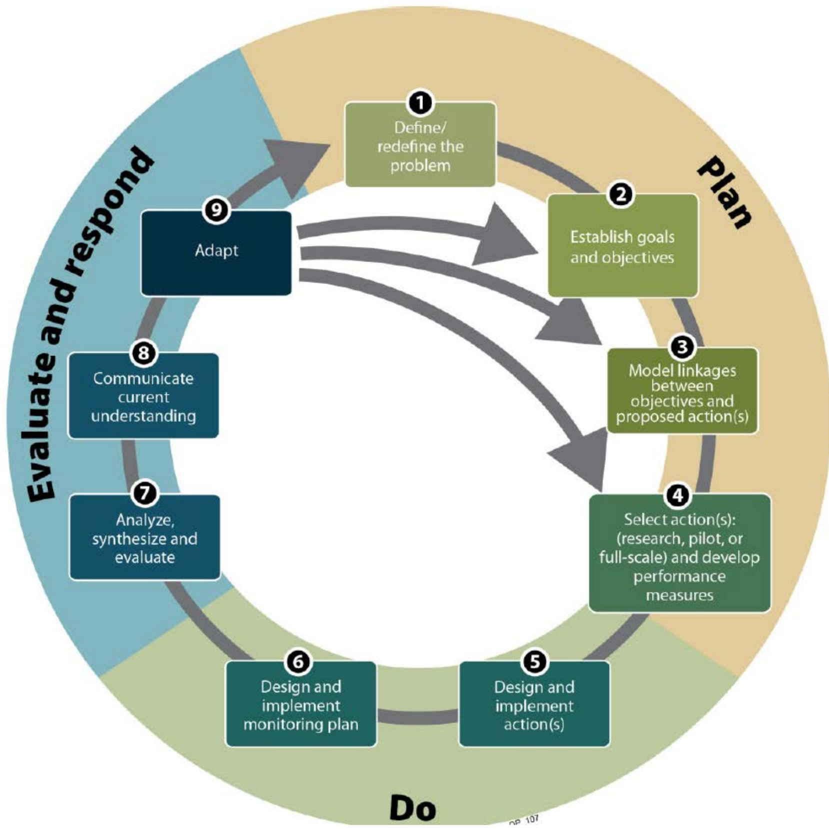

Figure 17. Nine-step adaptive management framework for the Delta. Reproduced from Figure C-1 of The Delta Plan (Delta Stewardship Council, 2013).[40]

The framework in Figure 17 was also included in a document entitled, "Improving adaptive management in the Sacramento-San Joaquin Delta."[42] This 2016 report defined adaptive management as a "science-based, structured approach to environmental management," and provided eight major recommendations. Among them were recommendations to assemble an appropriate mix of "experts, agency leaders, resource managers, practitioners, scientists, stakeholders, and regulators" to develop a coordinating team; to support adaptive management with funding that is dependable and flexible; to design monitoring protocols; to integrate science and regulations to enhance flexibility; and to develop a framework for setting decision points or thresholds that will trigger a management response.

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[41] Ibid at p. C-3

[42] Delta Independent Science Board (2016). Improving Adaptive Management in the Sacramento-San Joaquin Delta. January 2016. Available at http://deltacouncil.ca.gov/docs/final-delta-isb-adaptive-management-review-report.

An example of an adaptive management program that could serve as a model, with one significant adjustment, for the WaterFix Project is the Water Operations Management Team (WOMT). The WOMT and its proceedings also provide an example of the level of detail that should be included in describing an adaptive management program and the criteria that are considered and used in the decision-making process. The WOMT was developed under the CALFED Bay-Delta Program collaborative agreements and resulting ROD to contribute to and advance adaptive water management in the Delta. The WOMT consists of managers of Reclamation, FWS, NMFS, DFG, DWR, and the U.S. Environmental Protection Agency (EPA), who meet frequently to discuss CVP/SWP operations and fishery issues.[43] The WOMT makes decisions about project operations in open meetings, the results of which are documented and publicly available.[44] Included in these summaries are descriptions of the criteria or triggers that are used to make decisions about project operations; examples of these criteria are Delta Cross-Channel operations; salvage triggers / catch indices at specific locations in the system; estimates of fish distributions at specific Delta locations; and flow criteria at specific locations in the Delta, such as Rio Vista.

Despite multiple recommendations for adaptive management specific to the Delta, and despite existing models of adaptive management that have been applied within the Delta, the FEIR/EIS provided almost no detail on the AMMP proposed by DWR. The FEIR/EIS fails to include the details and components of adaptive management for the Delta that have been described consistently by the scientific community since at least 2009. Yet changes in project operations have significant potential to harm water quality and M&I beneficial uses within the Delta. Without a clearly structured, well-defined adaptive management proposal, the thresholds or decision criteria that would result in changes to operations, the process that would be used to change operations, and the impacts of those changed operations cannot be determined.

The FEIR/EIS should have provided additional detail on the process, participants, conceptual models, monitoring, performance metrics, data management, and goals and objectives of the proposed AMMP that will be used to adaptively manage project operations. Information that should be provided includes, but is not limited to, the goals and objectives of the AMMP; decision criteria and a description of the type(s) of information that will be considered to implement changes in operations; logistical details regarding who will participate, when they will meet, and how members of the public or water users can participate in the process; details of the monitoring, data management, data sharing, and decision-making process; and procedures to be implemented when disputes or disagreements occur and cannot be readily resolved. The major adjustment to the WOMT approach that is required for the proposed WaterFix project is to include measures or triggers based on the protection of water quality for M&I use, and the formal inclusion of representatives of M&I drinking water intakes within the Delta in the decision-making process.

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[43] U.S. DOI. 2008. Central Valley Project and State Water Project Operations Criteria and Plan Biological Assessment. https://www.usbr.gov/mp/cvo/OCAP/docs/OCAP_BA_001.pdf

[44] A summary of WOMT decisions can be found at: http://www.water.ca.gov/swp/operationscontrol/calfed/calfedwomt.cfm

5. The impacts of the WaterFix Project are not disclosed in the FEIR/EIS

The WaterFix project as presented in the FEIR/EIS poses multiple "Potentially Significant Impacts"[45] as defined by CEQA. Water quality modeling performed by DWR has clearly shown adverse impacts that "violate water quality standards" and "otherwise substantially degrade water quality."[46] In addition, the increases in chloride concentrations resulting from the project may "require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects."[47] Not only does the WaterFix project show adverse water quality effects, these effects were not adequately disclosed.

The Boundary 1 and Boundary 2 scenarios, to our knowledge, are not discussed in any detail in the body of the FEIR/EIS, and do not appear to have been used in DWR's determination that the proposed WaterFix project would have "less than significant/not adverse" impacts on chloride at CCPP#1 in Rock Slough – the same location as the City's intake. In contrast, the other proposed project alternatives—including Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, 9, 4A, 2D, and 5A—were discussed explicitly in the FEIR/EIS.

The preferred alternative, Alternative 4A, is the basis for the FEIR/EIS's determination that the impacts of the Project will be "less than significant/not adverse." However, DWR has disclosed that substantial water quality impacts associated with the other proposed alternatives, including impacts that are "significant and unavoidable (any mitigation not sufficient to render impact less than significant)."[48,49] DWR has also disclosed that the Project may operate to the Boundary 1 and Boundary 2 scenarios (as discussed in Section 2.1) as the project evolves and the AMMP is implemented. DWR states in the FEIR/EIS that, "As shown in Appendix 5E, the operation of the future conveyance facility under a possible adaptive management range represented by Boundary 1 and Boundary 2 will be consistent with the impacts discussed for the range of alternatives considered in this document" and that "Boundary 1 and Boundary 2 also encompass the full range of impacts found in the analysis prepared for H1 and H2 (as well as H3 and

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[45] As defined by the CEQA Environmental Checklist Form

[46] CEQA Appendix G: Environmental Checklist Form, p. 286.

[47] CEQA Appendix G: Environmental Checklist Form, p. 291.

[48] FEIR/EIS Figure 8-0a, Comparison of Impacts on Water Quality. This figure notes that "substantial / adverse" impacts are associated with Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, 9. The FEIR/EIS does not include or describe the Boundary 1 and Boundary 2 scenarios within this table.

[49] FEIR/EIS at Table ES.4.2 finds that chloride impacts for scenarios 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, 9are both "significant and unavoidable (any mitigation not sufficient to render impact less than significant)" and "adverse.") Again, the Boundary 1 and Boundary 2 scenarios are not included or described in this table summarizing project impacts.

H4)."[50] Because of this, the impacts associated with the Boundary scenarios should be considered potential impacts of the WaterFix project.

Appendix 5E contains an arguably more specific reference to the impacts associated with the boundary scenarios:

> *"Consistent with the goals of this analysis, the nature and severity of the impacts generally fall within the range of impacts disclosed under Alternatives 1A and 3 for Boundary 1, Alternative 4H3, Alternative 4H3+, and Alternative 8 for Boundary 2, and Alternative 4H4 and Alternative 8 for Scenario 2."*[51]

Based on this assertion, Exponent reviewed the CEQA and NEPA impact conclusions of Alternative 1A, Alternative 3, and Alternative 4 (H1 and H2), which DWR asserts would demonstrate similar impacts to the Boundary 1 scenario. DWR discloses that Alternative 1A "would result in increased water quality degradation and frequency of exceedance of the 150 mg/L objective at Contra Costa Pumping Plant #1 and Antioch, the 250 mg/L municipal and industrial objective at interior and western Delta locations on a monthly average chloride basis… Additionally, the predicted changes relative to the No Action Alternative indicate that implementation of CM1 and CM4 under Alternative 1A would contribute substantially to the adverse water quality effects (i.e., impacts are not wholly attributable to the effects of climate change/sea level rise)."[52] In addition, "Relative to Existing Conditions, Alternative 1A would result in substantially increased chloride concentrations in the Delta such that frequency of exceedances of the 150 mg/L Bay-Delta WQCP objective would approximately double… Additionally, further long-term degradation would occur at Antioch, Mallard Slough, and Contra Costa Canal at Pumping Plant #1 locations when chloride concentrations would be near, or exceed, the objectives, thus increasing the risk of exceeding objectives."[53] The NEPA effects and CEQA conclusions reached for Alternative 4 (H1-H4) are similar, noting that "All of the Alternative 4 H1-H4 Scenarios would result in increased water quality degradation with respect to the 250 mg/L municipal and industrial objective at western Delta locations on a monthly basis" and that "The predicted chloride increases constitute an adverse effect on water quality."[54]

Thus, although DWR's conclusion is that impacts to water quality as a result of the preferred alternative (Alternative 4A) will be "less than significant/not adverse," DWR has disclosed within the FEIR/EIS that it may operate to scenarios that will produce "substantially increased chloride" and "long-term degradation" at the City's intake location, and that "predicted chloride increases constitute an adverse effect on water quality." In fact, DWR has characterized these

[50] FEIR/EIS p. 3-288

[51] FEIR/EIS Appendix 5E, p. 5E-170.

[52] FEIR/EIS p. 8-288

[53] FEIR/EIS p. 8-288/289

[54] FEIR/EIS p. 8-504.

impacts as "significant and unavoidable (any mitigation not sufficient to render impact less than significant)."

DWR seeks flexibility through the AMMP to operate to the boundary scenarios as well as within the range of the eighteen (18) scenarios for which DWR discloses salinity impacts in the Delta that are "significant and unavoidable (any mitigation not sufficient to render impact less than significant)." Exponent's analysis of DWR's model results confirms DWR's conclusions that its own modeling indicates that the project will cause significant adverse impacts to water quality at the City's intake location. Exponent's analysis demonstrates that the Boundary 1 operations will result in the loss of the City's ability to use water at its intake for significant periods of time.

In sum, DWR's conclusion that the water quality impacts of the project will be "less than significant/not adverse" is not credible and is contradicted by its own analyses, which have found "significant and unavoidable" impacts that cannot be mitigated and that DWR expects to occur within its planned operating range. The significant and adverse water quality impacts of the project are not disclosed in the FEIR/EIS.